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EVOLUTION, AND MAN'S PLACE IN NATURE

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AND

MAN'S PLACE IN NATURE

BY

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PREFACE

In this volume, I have undertaken discussion of the problem concerning Man's Place in Nature. The discussion proceeds from the standpoint of Evolution of Organic Life, as maintained by Mr. Darwin, and by Mr. Alfred Russel Wallace. The main objects are to trace the evidence of man's relation to the continuity of life on the earth, and to describe the distinctive characteristics of human life itself.

Not without misgivings and apprehensions, have I undertaken this difficult task. Not without diffidence, do I now submit the outcome to criticism. I fully recognise the demand which science makes on the teachers of philosophy, and I here humbly offer a contribution towards its satisfaction. Whatever of failure may appear in this attempt, I may have succeeded in so far opening the way through the entanglements encompassing our higher biological problems. I am not without hope that these pages may carry help to many who have found it difficult to reconcile with acceptance of evolution, their

cherished convictions as to the responsibilities of rational life.

Since the publication of my work on *The Relations of Mind and Brain*, I have been closely occupied with the problem here discussed. During these years, I have been laid under deep obligation to many friends, whose valuable aid these prefatory lines enable me cordially to acknowledge. I have been specially indebted to my colleagues, Sir William Turner, Professor of Anatomy; Professor Rutherford, Professor of Physiology; and Professor James Geikie, Professor of Geology. I owe grateful acknowledgment to Mr. George Brook, Lecturer on Embryology in the University, for important suggestions bearing on his department of research. Throughout my investigations, I have been constantly indebted to my son, Mr. William Leadbetter Calderwood, Director of the Marine Biological Laboratory, Plymouth. In connection with revisal of proofs, I have been under many obligations to Mr. Charles M. Douglas, my Class Assistant in the University.

My original plan included a series of illustrations in Comparative Embryology. I accordingly applied to Mr. Murray, Publisher, for use of the two illustrations on p. 10 in Darwin's *Descent of Man*. In the kindest manner, and with the approval of Professor F.

Darwin, these illustrations were placed in my hands, a generosity which I greatly valued. Ultimately, however, it proved impossible for me to carry out my purpose in complete form, and I was led to prefer reference to authorities generally accessible. I desire in this way to indicate my sense of obligation to Mr. Murray, for the readiness with which he responded to my request.

H. CALDERWOOD.

UNIVERSITY OF EDINBURGH,
4th January 1893.

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EVOLUTION AND MAN'S PLACE IN NATURE

CHAPTER I

EVIDENCE FOR EVOLUTION

For scientific thought, the most obvious need is an adequate representation of man's place in nature. The general acceptance of Darwin's theory of Evolution gives force to the demand for discussion of this problem. Whatever differences of opinion as to this theory may still exist, few naturalists can feel reluctant to acquiesce in Wallace's statement that Darwin 'did his work so well that "descent with modification" is now universally accepted as the order of nature in the organic world.'[1]

Acknowledging this, there is need for fuller study of man's place in nature. The distinctive features of human life must be depicted, and must thereafter be interpreted in relation to the wide range of natural history. This task can be successfully accomplished only by regarding Nature as a whole,—a unity constituted by the most intimate correlation of all its parts. If man's place is to be thus studied, it must

[1] *Darwinism*, by Alfred Russel Wallace, Pref. v.

be with the patience of which Darwin set an impressive example in his observation of lower forms of life.

In treating of man's position, we regard him as the most conspicuous figure in a thoroughly organised system. It is impossible to contemplate human life as a thing apart or isolated. We must study man as related to the general scheme of Nature. By 'Nature' I mean the whole system of things in the midst of which we pass our lives. 'Nature' is often placed in contrast to 'Man,'—and so the term may at times be used here,—but in the structure of the main argument 'Nature' includes man and his efforts. In developing the argument, it will be requisite to include things familiar to all, along with the latest results of scientific research. Only thus can we have a solid basis for extended investigation as to man's place.

Further, as indicating provisionally the attitude assumed, I hold that no reasonably successful account of the universe can be presented, which does not accept the more general conclusions of Darwin, along with results of more recent research, which have at once sustained, and in some degree modified, his theoretic conclusions. Whatever limitations are to be assigned to the theory, we must at least grant that a law of Evolution has had continual application in the world's history. How much is involved under this law may still afford matter for large debate; nevertheless, it is generally agreed that a more accurate conception of the history of things has been obtained as the result of the researches in which Charles Darwin and Alfred Russel Wallace have led the way.

How the appearance of life is to be explained is matter of conjecture. So far as the investigations of natural historians suggest, we must speak of the 'origin' of life, not of its 'Evolution.' Evolution supposes existence: Evolution, in the history of organism, presupposes organic life. There was a lower form from which a higher had been evolved. Biological progress results from the fact that life, in each of its forms, moves towards the perfection of its kind. In natural history, therefore, life is taken as existing, a reality already present, given at some earlier stage in the world's history. Evolution cannot be a complete natural history; at most it is a scientific account of later stages in the history of the universe. Darwin saw this, and stated his position quite clearly, claiming one or more primordial forms. Huxley puts the position strongly against spontaneous generation: 'The fact is, that at the present moment there is not a shadow of trustworthy direct evidence that abiogenesis does take place, or has taken place, within the historic period during which existence on the globe is recorded.'[1] Nägeli, a high authority as to vegetable life, holds that among known living beings there are none which could have arisen by abiogenesis.[2] The presence of life supplies the scientific basis on which Darwin rests, when observation leads him to this declaration:—'I view all beings, not as special creations, but as the lineal descendants of some few beings which lived long before the first bed of the Cambrian system was deposited.'[3]

[1] 'Biology,' *Encyc. Brit.* 9th ed.

[2] *Mechanisch-Physiologische Theorie der Abstammungslehre*, p. 83.

[3] *Origin of Species*, pop. ed., p. 402.

If only this implication be recognised, that the *origin* of life lies behind its *evolution*, we need not linger to conjecture how many primordial forms it may be necessary to admit, nor need we inquire as to the history of the appearance of these. Speculative questions may be left in abeyance for the present. They will assert themselves in good time, though they are held in reserve at this early stage. For commencement, we are restricted to the history of the existing. Afterwards, speculative thought may claim its rights.

Granting that Evolution supplies the key to a large part of the natural history of life on the earth, progress has not been by a single grand movement, as when the tidal wave rises in the ocean, or as when the course of the river has been determined by the configuration of the valley. The law of Evolution has, indeed, had constant application, but it has not worked precisely the same results in all cases. Environment has presented varying conditions, and the consequence has been endless diversity in the history of life itself. The laws providing for evolution have, however, operated so constantly, that we should not seriously err, if we were to depict the history of life as a unity, representing a constant and world-wide progress. Still, adaptation to environment has been fruitful of varieties. Though 'the struggle for existence' has not been by any means uniform, it has been sufficiently general to rank as a formative cause. Exact estimates of its efficiency will bring us to restricted areas of food-supply, or areas more or less crowded with competitors; but the struggle does not disappear even when food is abundant, and demand

comparatively small. As life has multiplied on the earth, however, demand has increased, and struggle has become more serious. World-history runs through this widely extended conflict. Immense sacrifice of life is the consequence; but in the midst of all, and by means of struggle occasioning death very widely, advance of life has been gained, so that it is reasonable to speak of 'survival of the fittest'; and thereby improved species have appeared.

Human history must be traced within this world-history. Humanity is not exempt from the conditions of progress described. For the members of our race, as for the lower animals, it has proved true that variety of surroundings, more or less favourable, has presented variety of result, as in the history of different tribes and nations. What is required, therefore, for an adequate representation of Man's place in Nature is a more searching scrutiny of his relation to the general laws of existence.

Wide and careful as was the research of Darwin, his accumulated results have much more bearing on animal life, and even on lower types of that, than on human life and character. Exact conclusions are unattainable as to the number of lines of biological advance, and the variations within these lines. That there has been general advance is beyond dispute; but as the risks to life are many, there are possibilities of reverse by deterioration. It is accordingly needful to allow for manifold deviations. Mr. Herbert Spencer has properly emphasised this in saying that: 'Organisms may vary not only in respect of their structures, but in respect of their tendencies to do this or the other, in all kinds of ways,

—many or most of the ways at variance with welfare.'[1]

The general history of the evolution of life on the earth presents these two marked phases. *First*, Life finds in environment provision for its continuance and growth. Life thus shows dependence on an inferior order of existence. *Second*, Life, in unfolding, adapts itself to environment, thereby illustrating its superiority. Life is the key to progress; conflict is an inevitable condition of life, and out of this conflict comes general advance. However attractive the result, there is something startling in the fact that sacrifice of life belongs to the conditions of progress. Whatever the moral difficulty here,—and it is particularly great as illustrated in the bitter experience of men encountering the evils of 'over-competition,'—there can be no doubt that a law of sacrifice is included among the conditions of progress. Within the history of the world's advance, there lies continually a history of enfeeblement and death. Evil attends on the good. However great the gain in the world's history, suffering and sacrifice still continue. Biology is fruitful of ethical perplexities. Yet, through all this mixture of good and evil, there is provision for general advance, in the persistence of life. The inherent tendency to progress, belonging to life in every form, is the mainstay for thought in seeking interpretation of Nature. The conditions of the material world, of organic life, and of moral life combined, provide for the history of an orderly universe, the growing understanding of which brings

[1] Letter to Dr. Martineau, in Appendix to his *Types of Ethical Theory*, 3d ed. vol. ii. p. 570.

ever-increasing reward to scientific research. For organic life, 'warmth, air, light, moisture, food,' are 'the mightiest impulses which determine the manifold variety of the forms of living beings.'[1] When from organic form we pass to the ethical character in man, thought proves a grander agency by which a nobler life unfolds in the world. Through all this, the law of heredity provides at once for transmission of variations, and for further advance. Nature, taken in its highest aspects, appears as a living unity, with a history ever unfolding in fresh acquisitions. Scientific controversies, however wide in import, have at least a common basis in unchangeable laws of progress, ever deepening their impress on the face of Nature. Darwin and Wallace, Weismann and Eimer are severed on points of large significance; but they are agreed as to the main laws of acquisition, and of inheritance securing the world's advance.

The great lines of evidence for Evolution of organism are broadly marked. The laws of growth for individual life come first in importance; persistence of species bears its testimony for inheritance; modifications of species tell of the moulding power of environment; the records of artificial selection, under the advantages of domestication, throw a broader light over the provisions of Nature, whether the records tell of enduring, or of temporary, deviations from the normal type. When human intelligence comes on the field, selecting and regulating results in animal life, we see still more vividly that progress is the law of Nature.

[1] *Organic Evolution as the Result of the Inheritance of Acquired Characters*, by Dr. G. Eimer, translated by J. T. Cunningham, p. 22.

Natural History, extended by records of domestication, opens the gateway into a large field of inquiry, where, since man belongs to Nature, the 'artificial' is only an additional phase of the natural. Variation artificially induced presents the results of superadded observation and direction by rational life; and this has been so widely extended, as to be essential to the system of things interpreted by science. Human Reason and Will have proved large factors in the earth's history. Through long ages, the highest life has been a directing power in the world, determining the history of subordinate forms. Natural and artificial selection have been combined in preparation of the system of organised existence with which we are familiar. The world now is an inheritance from all that the world has contained. This implies 'natural selection' in its larger sense. The 'art' employed by man, itself belongs to Nature. This enables him by selection of conditions to facilitate, and even to intensify, the action of 'Nature.' 'Artificial selection' is not *extra naturam*. The distinction between natural and artificial is of obvious value to us, but there is no cleavage in Nature itself.[1]

Our accepted inductions need to be harmonised by extended interpretation of Nature. The history of the theory of Evolution carries this lesson written broadly over many of its pages. While strict observation has done vast service, analogy has been allowed more than its legitimate share of influence; not unfrequently the particular has been unduly over-

[1] Not without reason does Spinoza protest against the tendency to treat of man as if his life were *imperium in imperio*. *Ethics* 1. Appendix.

shadowed by the general. Not easily is a full sight of cosmic causes obtained. Deliverance from danger of hasty induction must be worked out by persistent research, and unshrinking criticism. Division of labour among naturalists, will provide for attention to every order of life in our further study of the scheme of existence. Advance in science deepens our conviction of the marvellous intricacy of Nature's methods. Slowly we shall come to learn how temporary uses are served, while some advance is being made towards a general end. 'As individuals grow, so the whole world of organic forms has grown up from simple beginnings;'[1] and even so, a complex system of law is now working for much grander results in ages to come.

If we are truly to know, and, thereafter accurately to interpret according to knowledge, we must be contented with a slow elaboration of results. While analogies supplied by individual growth are valuable, the complex conditions affecting life over the wide world carry us far beyond analogical inference. The conception which a theory of Evolution has made possible, needs to be sustained by deeper research as to the cosmic causes, and to be guarded specially against the fallacy which would find in the less the *cause* of the greater. Too readily do we speak of the lower *producing* the higher, tending to overlook the primary truth, that only the mature life produces the germ, organic life thus testifying by law of heredity that the greater produces the less. However surprising it be that a microscopic germ contains within it the promise of the normal characteristics of the

[1] *Organic Evolution*, Eimer.

species, the efficiency of the mature life cannot be overlooked. The law of inheritance has these two sides of application; transmission is the condition of inheritance. While, then, imagination gathers aid from the unfolding germ, it must figure things in harmony with the grand truth, that potentiality within the germ depends for its action upon potentiality operating beyond itself.

The intricacy of embryological problems—such, for example, as those concerned with development of the special senses—may illustrate the largeness of demand on caution and patience. The fact of evolution is unquestionable. Our general conception of the laws of advance may be approximately accurate; but there remains a large unexplored area of investigation. We have, indeed, a working hypothesis of great value; but the further we advance in the work of interpretation, the more difficult does the task become. Man's place presents in itself a problem complicated beyond all other problems in Nature. When we turn to this problem, our method becomes more intricate in application, for external observation must be supplemented by reference to inner experience, while within our consciousness there is much that points to conditions hidden even from the rational agent himself. What is known of human organism by dissection, and by microscopic inspection of minute structure, supplies no measure of the activity distinctive of man. There cannot be a successful attempt to explain human activity by reference to the functions of animal life. The outstanding perplexity here must largely influence our theory of Nature itself.

Along with the higher aspects of human activity,

the date of man's appearance on the earth becomes a historic question of primary importance for our general conclusions. Testimony from fossiliferous strata in the earth's surface has accumulated to support the view that a much more remote date must be assigned for man's appearance on earth than had been previously supposed.[1] The first effects of this change have been revolutionary. One thing, however, stands out clearly. The reconstructive work following admission of man's antiquity, must assign to human agency a much larger place in natural history than current hypotheses suggest. By this admission, the problem of man's place in Nature is increasingly complicated. Literary history bears only a small part of actual history. The earth's crust is the earliest chronicle of human activity. We transcend the so-called 'historic period,' continuing to trace with certainty far beyond it, evidence for intelligence such as belongs to men now. The distinction between 'historic' and 'prehistoric' times is relative only to our dependence on literary records. 'Historic certainty' is not restricted to chronicles. It may even more readily be found independently of documentary evidence. Far into 'prehistoric' times we are conducted in thought by reference to remains which can be deliberately examined. It is in these silent regions of unwritten history, as it is over the wide moors of Scotland, where patches of green sward mark sites of former homesteads, abandoned by families whose descendants have sought more promising fields for enterprise. There is, then, no exact line of demarcation visible between historic and prehistoric times. In more remote periods, measure-

[1] *The Antiquity of Man*, by Sir Charles Lyell.

ment of time can be only by reference to advance manifest in the remains of human industry. A chipped flint for an arrow-head, or a polished stone for an axe, bears witness for a rational life. Here we have evidence of man's presence in the world, as reliable as any we find in folk-lore, in folios, or in manuscripts.

To fix the date of man's appearance on the earth may not prove an easy thing; nor is it essential here that we should be able to do so with exactness. We judge of epochs by signs of intellectual advance, thus including many ages prior to those from which written testimony has come.[1] Some see in this large extension of human history, valuable support for an Evolution Theory. The earlier the appearance of man, so much easier, it seems to them, must it prove to bridge the chasm between animal and human intelligence. But the force of reasoning flows in the other direction. Geological records require us to extend human history beyond the appearance of such an animal as the dog, to which we now specially refer, for evidence of animal intelligence. The antiquity of man thus constitutes a special perplexity for a theory of evolution, even while we recognise that 'antiquity' is a relative term, having a meaning for the earth itself, immeasurably beyond the term of human existence.

In the history of our race, we go back to a period fitly named 'the stone age' (Neolithic and Palæolithic). Our museums contain arrow-heads and axes supplying abundant evidence of the antiquity of man. That the remote age was intellectually a less advanced age than the later, is true. The tools are of primitive simplicity, for appliances at command are few; but along with

[1] See Lyell's *Antiquity of Man*, p. 7, and p. 228.

this poverty of material, there are no traces of poverty of intellect. Intelligence, here traced as having been at work in order to produce a sharpened instrument, only waits for better material, by use of which intelligence itself will be quickened. Very much has thus been worked into human intelligence since the stone age, for understanding has steadily widened its range by discovery of wealth in Nature. The improved instruments of successive ages are only indirect testimony to intellectual progress; still more valuable testimony is found in the widening range of language, in increase of human comforts, and, in later ages, accumulation of literary treasures. Imagination needs effort to span these vast stretches of time. There is a very wide chasm between the stone-axe and the steam-hammer; between arrow-heads and a forty-ton gun; between the shell-heaps of rude settlers on the coast, and the scientific inquiries concerning marine biology. Rational life has held the field through long ages; during these it has persistently prosecuted discovery; while so engaged, it has been constantly utilising fresh knowledge of Nature's treasures. What is to be said of the origin of this life, is a question lying behind the manufacture of spear-heads and the accumulation of shell-mounds. No one suggests that man found axe-heads and stone-hammers lying ready to hand.

In developing the theory of Evolution, Darwin could not have selected any other course than that which he adopted; but when an attempt is made to include man, there is manifest disadvantage, arising from the fact that the structure of the theory has been determined mainly by study of animal life. Advantages

for the earlier stages of research thus turn to disadvantages. 'Animal' bulks so largely, during elaboration of the theory, as to favour a tendency to view the 'rational' in reduced proportions. Comparative biology is apt to hinder appreciation of perspective. Nothing can abate our interest in natural history, intensified as it has been by the problems which Charles Darwin has presented. But, as soon as we advance to consider man's place in Nature, we are warned how much of observation had been previously concentrated on the lower forms of life. No one can depreciate observations as to ants, and pigeons, and various breeds of dogs and horses. These observations have greatly extended our knowledge of the universe. But such detailed research into conditions of animal life, suggestive as it is, carries us far apart from man. Full value is readily given to it, without ascertaining anything bearing on the question whether 'natural selection,' and 'survival of the fittest,' have had much to do with the history of national life in the world. The leading workers united in building up the theory of Biological Evolution, have not been familiar with psychological inquiry. The intricacies of rational procedure have not engrossed their interest. Mental philosophy has, however, had some compensation in this, that comparative research has opened up new phases of experimental psychology, yielding large increase of knowledge as to the relations of the nerve system to the faculty of interpretation belonging to rational life, and helping much towards fuller appreciation of the unity of our life, while distinguishing the physical from the mental. Alfred Russel Wallace has clearly shown how many are the perplexities for Darwin's theory, when the

attempt is made to account for man's rational powers, 'by gradual modification and development from the lower animals.'[1] On the other hand, manifest gain has accrued from spread of the spirit of observational science within the province of mental philosophy. Bain, Spencer, Sully, Ladd, Lloyd Morgan, Romanes, and many more have laid us under special obligations, while Wundt and Münsterberg, and Helmholtz and Ferrier, have opened up the whole field of experiment connected with the sensory and motor systems, as these are related with experience and intelligent interpretation. Observations have thus accumulated on the borderland where sensibility meets consciousness. Much has here been done in elucidation of the organic conditions of human experience. But, valuable as is such work, it leads us only a little way towards solving the perplexing problems concerned with man's origin. A fresh survey of 'animated existence' is required from the new stand-point afforded by the theory of Evolution. We need to see things in true perspective, from man's central position in Nature. In finding levels for the new pathway of science, after alluvial deposit has been cleared off, and the hard clay has been pierced, we face the mountain.

The difficulties encountered by Darwin at the outset were largely occasioned by the novelty, even the perplexing strangeness, of the problem. Common observation, while including the most serviceable facts, had not suggested research in the direction which Darwin took. Ordinary observers sought immediate advantages; did not at all concern themselves

[1] *Darwinism*, p. 461.

further, not having any direct interest in a constructive theory of cosmic causes, conditions, and results. In this way it happened that special knowledge, carefully accumulated, had a value for science, unnoticed by those who considered only market values. Animal fanciers were gathered into distinct groups. Pigeon fanciers were commonly a different class from horse fanciers. Science suffered loss from this severance of classes interested in improved breeds of animals. The one set of men were not 'well up' in the special knowledge which another set had 'at their fingerends.' Observations as to ants 'did not pay,' and were accordingly held cheap by men of a business turn of mind. Breeders of pigeons, and dog fanciers, had sheaves of facts ready to hand, when Darwin was still absorbed with the formation of coral reefs. But this circumstance, that common observers were so far in possession of the facts as serviceable for themselves, lent valuable support to the scientific observer, as he came slowly along the track.

When, however, the natural history of rational life is pondered, the situation of things is considerably different. We ought to know human life better than any other: but then, it is much harder to know. Our whole experience is such as belongs to rational life, acting within the conditions of organic existence; and this experience raises problems entirely new, involving human reason itself in deepest perplexity. It is comparatively easy to test the limits of muscular energy; it is far from easy to measure the possibilities of a rational life. Few men deliberately face the problems which rational life raises for itself, about itself. Of the men who have most patiently studied

these questions, none have solved them. The number of theories in mental philosophy is subject of common remark: the explanation lies in the depth of the problem. Scientific men and philosophers are apt to laugh at each other; the laugh goes round; the problems remain. A steady look into the unfathomed depths will awaken misgivings as to evolution of rational life from sensory existence. For a long time to come, we shall have to speak of rival schools of philosophy; one school having more affinity with the Darwinian theory than the other. The 'Experimental,' or Sensational, school of philosophy may with some warrant be said to have been preparing the way for Darwin. This is the school which relies mainly on the laws of association, connected with sensibility, for interpretation of human experience; it is the 'Sensational' school which finds the sources of intellectual life in feeling. On the other hand, the 'Rational' school, the 'transcendentalists,' who push behind and beneath experience in the attempt to interpret experience, make thought the pre-requisite, logically and historically, for human experience. They are regarded by their critics as men who are boring too deeply, getting into a quite unpromising region, more likely to find mineral, than to find mind. This battle of the schools must be fought out here. The problem of rational life cannot find solution in observations concerning the lower animals, however important these may prove.

Whatever be the ultimate award as to the range of Evolution in the history of life on the earth, there can be only one opinion as to the high honour due to Charles Darwin. Preoccupied with the clue he had

found, he manifested a noble determination in tracing the pattern worked out on the web of life. The first faint vision of it had an attractiveness known only to the discoverer. After long gazing upon it, he announced his conclusion,—Origin of Species by means of Natural Selection,—origin from allied species not far removed, involving preservation of favoured races in the struggle for life. Mr. Wallace, joint-discoverer, has done a generous and able piece of work in expounding the theory, and sustaining it by extended illustration of 'variations in organisms in a state of nature.'[1] The interdependence of vegetable and animal life, long familiar, began to appear in new lights. Form and colour in leaves and flowers, found new significance, it being proved that these have attractions for other eyes besides those of men, and that they guide the actions of lower orders of life in ways before quite unsuspected. Müller, Horner, Huber, Lubbock, M'Cook, and many more have enriched our literature with tributary evidence.

The interdependence of distinct families of animals was slowly demonstrated by an exceedingly varied series of observations. The dependence of life on environment has proved a subject of study fruitful in suggestion. In this relation, 'the struggle for existence' has come out conspicuously, after having, for a time, given serious perplexity. The tendency now is to assign to it even more than the records of natural history warrant. Observation, when concentrated on this struggle, is predisposed to overlook superabundance of supply, where it exists. On the other hand, when pondering how life feeds on life, we

[1] Wallace's *Darwinism*, see p. 128.

are ready to dwell with amazement on what seems the waste of life. Just here comes into view the new induction, 'survival of the fittest,' opening a pathway through a labyrinth of difficulties, even if it be remarked that the generalisation does not apply to human life, as it does to animal. Life is everywhere being tried and tested, and is thus, in course of its history, developed. Not the death in the world, but the life in it, becomes again the object most conspicuous. Life's slowly winding history has begun to appear distinctly. Death is for the sake of life. This is the later and grander induction. The system of organic existence in the world is being deciphered. In all directions it becomes apparent that if life is strangely sacrificed, such sacrifice secures that a stronger life shall emerge to fill a larger place in nature.

This movement of thought must push upwards, seeking interpretation of man's place in Nature, stimulated by all that now lies visible on lower levels. Man is the crowning feature in the scheme of existence. How shall we account for his appearance? What is his place in natural history? As he is the highest, is he also the latest? When we have traced man to a remote age, can we account for his appearance by the history of earlier life on the earth? How shall we deal with the 'extremely remote epoch,' 'before man had arrived at the dignity of manhood,' as Darwin put it?[1] Passing further down the stream of time, after human agency has become a factor on the scene, has the progress of lower orders gone on as before, perhaps even at accelerated pace? And if so, what is man's

[1] *Descent of Man*, p. 46.

place in the midst of all this systematised order? Is he product, or agent, or is he in some sense both? How has he found his place on the summit of existence, and what has he done since coming to his heritage? Certainly his work has been neither of short duration, nor of small significance.

Science has carried us far beyond elementary questions here. What we have to seek is a full harmony of the complex system of existence,—the true conception of the cosmic system. Accepting as ample the evidence for Evolution, we still need vastly to expand our conceptions of Nature. The antiquity of man, the progress of life on the earth before his coming, and the progress since, need to be harmonised, as they have not yet been. In a very large sense it holds true that the crowning feature is not even man's nature, but man's work, as that has contributed towards the order everywhere visible. A natural history method, to be true to its conditions, must make account of the entire range of human history, tracing human causality as it has been engaged in higher work than anything achieved in the history of animal life. Questions of comparative intelligence of animals and men, lie in our rear at this stage. We are advancing into the field of rational agency; we are coming in sight of the characteristics of a moral life, in which animals have no part. Action from above downwards is clearly recognised, when man's agency is in contemplation. Illustrations of this are all around. Facts as to 'artificial selection,' which Darwin found helpful in the earlier stages of constructive effort, present part of the evidence to which reference is now made. John Stuart Mill's dis-

cussions as to the extent to which 'right conduct' requires kindness to the lower creation present further testimony. And besides, there falls to be included, a comparatively neglected region of inquiry, the consequences to animal life of the advance of human civilisation. From the epoch of man's appearance, the condition of things has been modified quite beyond anything capable of being explained by study of organism. It must, therefore, be recognised, as Professor Huxley has said, as not only 'convenient,' but necessary, 'to distinguish those parts of nature in which man plays the part of immediate cause, as something apart.'[1] The convenience experienced in this respect by the scientist, springs from the actual order of things in Nature. Man's place therefore becomes the chief problem to which all scientific inquiry must lead.

Evolution through struggle for existence, is only one item in the history of progress. Without it, we cannot construct any theory of things existing. We readily admit with Wallace 'the overwhelming importance of natural selection over all other agencies in the production of species.' But it is needful that we ponder the beginning, the continuance, the consummation of this process, comprehending all within a single scheme. We still need a deeper study of causes and of results. Croll puts the position admirably, 'The changes or motions in organic nature which result in an organism,' are 'not to be accounted for by forces which produce the motion, but by the cause or causes which *direct the operation* of the

[1] 'Struggle for existence'; *Nineteenth Century*, February 1888, pp. 165, 166.

forces.'[1] We have only made a beginning when we have by direct observation ascertained the facts; we push further into the heart of things when we discover the processes which work out results; but we do not complete our inquiry until we account for the origin of the movements, the true beginning of all that occurs, 'the cause or causes which direct the operation of the forces.' On the other hand, if we are to seek a scheme of existence as a unity, we must pass away from investigations as to minute structure, and as to movements in cell formation, in order to enter on a fuller study of human life, in comparison with which all life besides is insignificant. Science has clearly decided what must be its crowning effort in the study of Nature,—the solution of the problem of man's appearance?

For answer, something more is needed than a history of human progress,—something larger even than a history of civilisation,—something wide enough to include the relations of man to the fixed laws of the universe, very specially to those laws providing for Evolution of species. Man is not only among the animals, but above them. 'All through his history, it has so been. The dominion of man must, therefore, count for a large thing in the history of the earth, at once modifying, and extending the application of the laws of Evolution.

The history of mental philosophy must be largely affected by the absorbing interest of this question. If interpretation of organic life has instructed philosophy, as it has, so will philosophy expand and enlarge our

[1] *The Philosophical Basis of Evolution*, by James Croll, LL.D., p. 7.

interpretation of the whole scheme of biology. The theory of Evolution has not made good its claims, without for a time obscuring larger questions. This is, however, only an incidental feature in the progress of observation and of thought. It is impossible to widen the range of reflection, yet dwarf the thinker. The oldest questions are still the newest, and these are the questions concerning the life, the powers, the destiny of man. It is impossible that the problems of philosophy should be of small significance in these times. Questions that have absorbed the interest of thinkers even from the days of Socrates downwards, cannot be cast into oblivion. Inquiries which have re-appeared from age to age throughout the history of men, civilised and uncivilised, must have their acknowledgment within biological science. Thus, the religious life, which has appeared in all divisions of the globe, and in all phases of tribal or national organisation, must find its logical position in natural history. Biology cannot at the same time include man, and exclude prominent characteristics of human life. Science having achieved the extension of its boundaries, must now give heed to all that has been enclosed. A greatly extended task has thus been thrown upon biologists. Those who undertake exposition of the laws of inheritance, must make full account of the heritage. Observations as to monkeys and apes being accepted as within the boundaries, their permanent value will be determined by their relation to human faculty, and to the work which the human family have achieved, from remote ages, in modifying and enlarging the conditions of life.

If Philosophy has often erred, as Spinoza main-

tained, by regarding man as *imperium in imperio*, as if all things were to be judged from the standpoint of human desires; nevertheless, there has been an actual *imperium*,—a true lordship of man throughout the earth. Neglecting to make account of this, biology must expose itself to deserved ridicule, on account of unfinished work. The biologist must include himself in his view of existence, or else he must be contented with the narrow field of a specialist, whose words have value only within a limited range of observation. Philosophy needs like warning. Deliverance from merely abstract thinking is a necessity. This escape must be achieved by philosophy itself, with reasonable gratitude to biology for forcing on this reform, for which Hegel resolutely and wisely pleaded. But the questions, raised at an early date by Aristotle, of separation and classification of the sciences, remain to this day. This additional problem we now have for treatment, how are all sciences to be harmonised in a manner equivalent to the unity found in Nature. Over this problem, the theory of Evolution has thrown a broad and steady light.

'Man is a being who doubly presupposes Nature, as he is a spirit which finds its organism in an animal body, and as it is in the system of Nature that he finds the presupposition and environment of his life.'[1] The philosophic spirit is thus in full harmony with the modern problem concerning man's place in the cosmos. The problem can be solved only on condition of full appreciation of what man is; and for understanding of this, there must be study not only

[1] *The Critical Philosophy of Immanuel Kant*, by Professor Edward Caird, LL.D., p. 10.

of man's organic life, but of the life of consciousness. The work of Descartes, in disclosing the conditions of thought,—still more, the critical philosophy of Kant, piercing deeper into the essentials of rational life,—the latest results of 'experimental psychology,' showing how thought-movements, and nerve-movements, coincide and co-operate,—and the best results reached by Darwin and his followers, must have fair and adequate estimate, if we are to travel towards a biological scheme which will hold its place in the interpretation of Nature.

CHAPTER II

LIFE IN ITS LOWER AND HIGHER FORMS

In order to approach larger problems with some regard to natural perspective, we must, at least, trace a pathway through the midst of the lower orders of life. We must even linger long enough by the way to ascertain the results of recent research into the general structure of organism, and into the hidden movements essential to organic life. We must ascertain what the microscopist has witnessed during his scrutiny of tissues, and of vital changes within these, which are invisible to the naked eye. In this way there will be secured at least a passing view of the common characteristics of organic life, suggesting the unity of organism in the scheme of existence.

Inclusion of vegetable with animal life is required, in order that living material may be contemplated in all its aspects. A botanist, such as Nägeli, has much to tell bearing on Evolution, as well as such students of animal biology as Darwin and Wallace. Professor Burdon Sanderson, in marking out the range of inquiry, has well said, we must begin with 'the elementary endowments of living matter, or living material,' as the latter phrase may apply to a single muscle in the body, or even to the microscopic hair of a plant. We are here touching the beginnings of life-history

when the relations between organic motion and exchange of material, are duly considered.[1]

Though we cannot here linger over these early stages of investigation, we must carry with us at least a general conception of scientific results. We must take 'the physical basis of life,' as Professor Huxley depicted it in his famous lecture, perhaps giving even wider range to the phrase. For, if we are agreed that all science is pointing towards a conclusion which interprets as a unity the world, material, organic, and rational, we must begin with the basis of life, outstretching all that has assumed organised form. We must see life springing up in the earth. We must see inorganic material, by subtle procedure of Nature, transformed into vital tissue.

The hypothesis that life originates under action of the mechanical and chemical forces operating uniformly throughout Nature, has been abandoned by competent judges. The most careful search has failed to discover spontaneous generation. When, however, it is considered that life belongs to the material order, drawing its sustenance from the material universe, there does not seem to be any insuperable logical difficulty to bar the supposition that it might originate under physical conditions. All that can be said with scientific authority is that Spontaneous Generation, (*abiogenesis*;—*generatio spontanea*), has not been recognised, after most painstaking search for it. Nevertheless there are some who cling still to the belief that mechanical and chemical forces may account for the origin of life. Nägeli favours

[1] Mayer's *Die Organische Bewegung in ihren Zusammenhänge mit dem Stoffwechsel.*

this hypothesis; and it is more natural to one studying life-history as seen in the vegetable world, than it is to one devoted to animal biology. While, however, Nägeli favours a 'mechanico-physiological doctrine of descent,' he admits that among known living beings there are none which could have arisen by abiogenesis, for the lowest plants have a 'cell-membrane, and the *monera*[1] cannot live independently, *i.e.* without the production from decomposition of other organisms.'[2] Professor Huxley puts the conclusion strongly:—'The fact is that at the present moment there is not a shadow of trustworthy direct evidence that abiogenesis does take place, or has taken place within the historic period during which existence of life on the globe is recorded.'[3] There is unbroken scientific testimony for the conclusion, that life comes only from life. In all its known forms, life is a manifestation of descent. Above the material basis of things, there appears a new start, presenting conditions of progress otherwise impossible. We do not find any explanation of life by reference to 'a certain disposition of material molecules.' Nor are we helped by finding that protoplasm,—the physical basis of life,—contains 'the four elements, carbon, hydrogen, oxygen and nitrogen in very complex union,' even though gravitation and moisture and heat are supplied as attendant conditions. 'If it is certain that we can have no knowledge of the nature of either matter or spirit, and that the notion of necessity is something illegitimately thrust into the perfectly

[1] The simplest of all organisms.

[2] *Mechanisch-Physiologische Theorie der Abstammungslehre.*

[3] 'Biology,' *Encycl. Brit.* 9th ed.

legitimate conception of law, the materialistic position that there is nothing in the world but matter, force, and necessity, is as utterly void of justification as the most baseless theological dogmas.'[1] Yet, let us not fail to mark that life is material, and that its simpler processes depend on chemical combinations and structural adaptations. Hence we naturally speak of 'living material' and of organic forms. Whatever we have to say, or to leave unsaid, as to the mode in which we may account for the appearance of life on the earth, unorganised matter is lifted into vitalised organic form. So obviously is this one of the 'seven world riddles,'[2] to use the phrase of Emil du Bois-Remond, that we cannot contemplate the new appearance, without astonishment at the movement pulsating with steady regularity. 'The spectacle afforded by the wonderful energies prisoned within the compass of the microscopic hair of a plant, which we commonly regard as a merely passive organism, is not easily forgotten by one who has watched its display continued hour after hour without pause or sign of weakening.'[3] These energies simply illustrate the activity constantly going on within the cells, whence all life-forms are developed. 'It appears to be a matter of no great moment what animal or what plant I lay under contribution for protoplasm, and the fact speaks volumes for the general identity of that substance in all living beings. I share this catholicity of assimilation with other animals, all of which, so far as we know, could thrive equally well on

[1] Huxley's *Lay Sermons*, p. 158.
[2] *Die Sieben Welträthsel*, 1880.
[3] Huxley's *Lay Sermons*, p. 137.

the protoplasm of any of their fellows, or of any plant; but here the assimilative powers of the animal world cease. A solution of smelling salts in water, with an infinitesimal proportion of some other saline matters, contains all the elementary bodies which enter into the composition of protoplasm, but . . . a hogshead of that fluid would not keep a hungry man from starving, nor would it save any animal whatever from a like fate.'[1]

Let us, however, for a moment suppose some large advance in scientific knowledge, carrying an explanation even of the origin of life. Suppose the secret at length discovered of the mode in which the forces of gravitation, with aid of moisture, light, and heat, are brought to bear on material molecules, so as to produce the lowest phase of living material. Suppose a mechanico-chemical theory of the origin of life were thus obtained,—what then? Even then, we have under observation only the very lowest and least phase of vital movement in the world, a mere speck or point of living material, a nucleus of vitality, or, at best, a mass of such material; and before us rises the stupendous conception of elaborating out of this the whole varieties of organism spread over the earth.

Proceeding on the results of investigations dating no further back than A.D. 1830, 'protoplasm,' the simplest living material, supplies the 'physical basis of life.' This soft jelly-looking substance is not structurally of a simple character, as was supposed when its existence was first recognised. Professor Sir William Turner, in his vivid and concise account of the cell theory, says it consists 'of two parts, viz., a

[1] Huxley's *Lay Sermons*, p. 147.

minute network of very delicate fibrils, and an apparently homogenous substance which occupies the interstices of the network.'[1] This is the basis of all life. By reference to this we are led to contemplate the two kingdoms, vegetable and animal, as one, for there is 'an essential correspondence between the elementary tissues of plants and animals.'[2] These two kingdoms, the one earlier, the other later, are the outcome of the material energies working in the natural history of the earth. With microscopic examination of protoplasm and the formation of a theory of cell-life, a promising beginning was made for interpretation of this history. The range of promise became apparent, when Theodore Schwann reached the conclusion 'that there is one universal principle of development for the elementary parts of organisms, however different, and this principle is the formation of cells.'[3]

A living cell is a nucleated mass of protoplasm, with or without a membrane for enclosure. It is not infrequently a closed vesicle, and may vary from $\frac{1}{100}$ to $\frac{1}{800}$ of an inch in diameter. Such cells constitute the basis from which the individual life in the world is built up. Each cell contains a nucleus which is an elementary organ, the active life-propagating agency; and still within this, there is a nucleolus which is the minute vital centre of action. Living material, even in its primary form of utmost simplicity, is thus strikingly complex. This living

[1] *The Cell Theory, past and present.*—Inaugural address to the Scottish Microscopical Society, by Professor Sir William Turner, D.C.L., President, 1890, p. 27.

[2] *Ibid.*, p. 11.

[3] *Microskopische Untersuchungen*, 1839.

centre is the simplest phase in which there appears an individuality in Nature. With discovery of the cell as the basis of vital function, Professor Burdon Sanderson says, 'the mystery which before belonged to the organism was transferred to the unit, which, while it served to explain everything, was itself unexplained.'[1] This discovery was the reward of the researches of Robert Brown, the English botanist, of Schleiden, and of Schwann. Professor Burdon Sanderson says of this discovery that it 'seemed to be a very close approach to the mechanism of life; but now we are striving to get still closer, with the same result. Our measurements are more exact, our methods finer; but these very methods bring us to close quarters with phenomena, which, though within reach of exact investigation, are, as regards their essence, involved in a mystery which is more profound the more it is brought into contrast with the exact knowledge we possess of surrounding conditions.'[2] Accepting life as the beginning of a new order of things, the fact is recognised as an essential feature in Nature, without an explanation of its origin having been obtained. We are familiar with vital movement, as movement of individual organism from its own centre. All that can as yet be said is that 'living material acts by virtue of its structure.' Descending as low in structure as a very minute centre, our knowledge depends on observation of its activity. The utmost efforts of science are limited to this. Professor Burdon Sanderson has said, 'if we are not

[1] 'Mechanism of Life in its Simplest Aspects,' by Professor Burdon Sanderson. *Nature*, vol. xl. p. 525, 1889.

[2] *Ibid.*, p. 525.

to fall back on that worn-out *deus ex machina*, protoplasm,' we 'must use analysis of function as the guide to the ultra-microscopical analysis of structure.' The first line of discovery for biology has been opened by observation of the activity of living cells.

Life is first propagated by division of the cell, originating a second cell. Beale's observations[1] are thus briefly described by Sir W. Turner:—'The elementary tissues of every living thing consists of matter in two states, the one an active, living, growing substance, composed of spherical particles, capable of multiplying itself.' The other 'is situated peripherally to the germinal matter from which it is produced; it is passive, non-living, or dead, incapable of multiplying itself.'[2] The former, Beale names 'bioplasm'; the latter, 'formed material.' Beale states that in some cases the germinal matter corresponds to the 'nucleus,' in others to 'the nucleus and cell contents,' so that the wall or membrane enclosing the cell is the only non-germinal portion. It was discovered by Strasburger and Flemming, 'that the nucleus in its passive or resting stage, consists, in addition to the nucleus, of threads or fibres, some finer, others coarser, formed of nuclein, and arranged in a reticular net-work, so as to form little knots at the points of intersection of the fibres.'[3] The nuclear fibres play an important part in the process of cell multiplication. During the movement which results in the formation of new cells, the fibres arrange themselves in loops, and form a spindle-like figure. Each loop-fibre splits up into two threads. These threads separate and pass to opposite

[1] Beale's *Structure of the Simple Tissues*, 1861; *Bioplasm*, 1872.
[2] *The Cell Theory*, pp. 26, 27. [3] *Ibid.*, p. 28.

poles of the spindle and form the nuclei of two new cells. This brief summary represents in outline the results of the closest observation of procedure in Nature's laboratory, where expansion of life occurs. 'Young cells arise from a parent cell by division of the nucleus, followed by cleavage of the cell protoplasm, so that each cell is directly descended from a pre-existing cell.'[1]

Microscopic cells, such as those described, contain the living principle in the tissues equally of vegetable and animal forms. The two kingdoms have thus a common basis in the protoplasm which is their essential condition. In the fixed order of Nature, the vegetable kingdom is that which is capable of producing protoplasm. 'Notwithstanding all the fundamental resemblances which exist between the powers of protoplasm in plants and in animals, they present a striking difference in the fact that plants can manufacture fresh protoplasm out of mineral compounds, whereas animals are obliged to procure it ready made, and hence in the long run depend upon plants.'[2]

We follow Nature's line of progression in rising from the simple cell to the germ cell or egg, which constitutes the first stage of embryonic existence for the animal. This introduces distinction of sex in the work of reproduction. On this higher level, each type of life springs from a fertilised egg. The ovum is fertilised by addition of the spermatozoon. In every such egg there is nutritive material, and a nucleus which is the centre of reproductive activity. This nucleus carries within it the characteristics of the species to which it belongs, illustrating heredity. Thus, when differentiation of sex has appeared, each parent con-

[1] *The Cell Theory*, p. 35. [2] Huxley's *Lay Sermons*, p. 138.

tributes to the new life encompassed within the egg. The fertilised egg passes through its earlier stages of development in the embryonic state.

'From these outlines of the history of life in its earlier stages, we must pass rapidly towards the more familiar stages of life subsequent to birth, specially to the sensory and motor activity belonging to animal life. Thereafter, we shall advance to the characteristics of intellectual life belonging to the higher orders of mammalia. We seek, as early as may be, in course of this investigation, to deal with marked differences appearing in organic life, leading onwards to the history of variations, and to the problem of origin of species.

On whatever phase of organic life attention is turned, structure must account for its activity. All organism includes apparatus fulfilling definite functions. With progress in development, we distinguish muscle, nerves, and nerve centres. The amount of force operating in development, must in any case be measurable. Diversities of capacity and of faculty come into view. From reference to these, discrimination of species arises In process of these comparisons, a steadily advancing complexity is manifest in the ascending scale of life. 'When new characters become persistent in a group of individuals,' and there is 'loss of the intermediate forms, then we speak of new species.'[1] Here we move into the field of special inquiry regarding relation of species, and man's place in Nature. Successive stages of differentiation in organic structure are observed. How do new forms of structure arise? This is the inquiry which has engrossed the attention of

[1] *Organic Evolution*, Eimer, Cunningham's translation, p. 23.

Darwin and of Wallace. How are new characters transmitted? This opens to view the differences between Darwin and Weismann. Under their discussions we are led to consider whether heredity is to be explained on the hypothesis of pangenesis, every part of the living organism of the mature life contributing to the germ-cell; or on the hypothesis that germ-plasm has an independent existence passing from one generation to another, with comparatively slight modification.

Through the midst of all these inquiries, yet quite beyond them all, we reach our main problem as to man and his place in Nature. In doing so, we contemplate the life conspicuously the highest on earth, a life distinguished by the exercise of rational power, thereby leading to achievements unapproachable by the highest animal life existing—unintelligible to them all. At this extreme, far removed from the researches just sketched as to cell-movement, we have to ask if it be possible to accept Darwin's view that 'there is no fundamental difference between man and the higher mammals in their mental faculties.'[1] No superficial or partial answer can suffice. We desire to see clearly in what respects man has his inheritance with the animals, and in what respect, if any, he has a faculty whose origin is unexplained by his share in a common heritage of organic life.

In dealing with the great problem of humanity, no suggestion is made as to the unsuitableness of discussions within the regions of comparative anatomy, and physiology, and physico-psychology. All these departments of research are essential to the study of

[1] *The Descent of Man*, p. 66.

man's place in Nature; but, after all these regions of inquiry have been exhausted, the distinguishing features of a rational life await explanation. Science itself being witness, the superiority of human life calls for still more searching scrutiny.

Students of philosophy will here gladly welcome the utterance of Professor Burdon Sanderson, as an exponent of the scientific position:—'There is little ground for the apprehension that exists in the minds of some, that the habit of scrutinising the mechanism of life tends to make men regard what can be so learned as the only kind of knowledge. The tendency is now certainly rather in the other direction. What we have to guard against is the mixing of two methods, and, so far as we are concerned, the intrusion into our subject of philosophic speculation. Let us willingly, and with our hearts, do homage to "divine philosophy," but let that homage be rendered outside the limits of our own science. Let those who are so inclined cross the frontier, and philosophise; but to me it appears to be more conducive to progress that we should do our best to furnish profound philosophers with such facts relating to structure and function, as may serve them as aids in the investigation of those deeper problems which concern man's relations to the past, the present, and the unknown future.'[1]

[1] *Nature*, vol. xl. p. 525.

CHAPTER III

THE CHARACTERISTICS OF HUMAN LIFE

THE rule which holds when dealing with the lowest phases of life, must hold when dealing with the highest life in the world. Function must determine interpretation of life-power. Whatever any type of life accomplishes must be explained by forces within it, —the inheritance with which the start is made by the individual. Everything beyond this must reckon as individual acquisition to be added to the records of advance.

Even a general appreciation of human life, as the crowning problem of Nature, suffices to show the importance of an accurate account of its functions. Whether we do, or do not, favour the hypothesis that human life can be explained under laws of Evolution, we are equally committed to the task of obtaining a full view of the life of our race, as contrasted with lower orders of life.

To present an adequate representation of human life is beyond doubt a very difficult task. Admitting the intimate relations of man and animals, and granting that these are strikingly manifested in analogies of organic structure, it is clear that the nature of man surpasses in a vast degree that of the highest animals. Man has no rival on the earth. This superiority is

recognised by all; yet, it is not easily explained by any one. The immense difference between man and animal is manifest in the most ordinary human action. The contrast comes to light under test of any action, even the simplest. Take the art of speaking. This quite simple act is indeed a very advanced phase of action in comparative physiology, but it is possible to the mere child, so far is the human species even in earliest years in advance of the fully-developed animal. The use of speech has in each case a history difficult to trace, for passing behind vocalisation, and inwards to brain action, we pass next into consciousness, when we note thought, purpose, memory, associations, feeling, and passions. When this complexity of exercise is considered, we see how it happens that nothing is more common than inability to explain the manner of doing the most familiar action. The difficulty does not in any case concern what is done, but only *how* it is done.

Notwithstanding this difficulty, the functions of our life are well known to us. They include many which are common to us with the animals, and many more not within compass of any animal. In some ways it should be easier for us to enumerate the activities of man, than to ascertain the habits of animals. The ordinary susceptibilities and activities of our nature are known to all. We can tell by experience what a man does and feels in the daily round of engagement. Familiarity with function must, therefore, be set over against our difficulties in interpreting the manner of their fulfilment. We do not readily agree, if we attempt to unite interpretation of mode with representation of function. Actions are familiar; theories

as to how these actions are done are fruitful of disputation. This familiar fact may prepare us for perplexities to be expected in seeking a scientific account of our own activity. The difficulty arises from the fact, that search soon carries us beyond observation. The consequence is that criticism of rival theories of procedure proves difficult even for highly educated men.

The simplest mode of approach to our problem is the comparative method, setting human life in contrast with subordinate types. We shall thus, as far as possible, escape abstract reasoning, keeping observation connected with the facts of natural history, and also assigning full value to the knowledge of human nature supplied by anatomy and physiology. We are not to consider man apart from his surroundings. We must be ready not only to say that nothing human is alien to us; but that nothing belonging to any life on the earth is without value in directing this inquiry. This wide range of interest is the more readily maintained, that a uniform plan of structure is seen to hold for all organic existence. Accordingly, a large proportion of life-characteristics are common to all forms of life. We must, therefore, first be occupied with common features, before enumerating those special. On this account, we may find it possible, so far as the earlier part of the discussion is concerned, to agree with Professor Huxley's[1] suggestion in favour of expressing facts in terminology applicable to things material. From the physiologist's point of view, this suggestion is natural. Words must, however, be applicable to things de-

[1] *Lay Sermons*, p. 135.

scribed. If by and by, we come upon facts of an entirely different order from those classified under physiological functions, we shall need an appropriate terminology to distinguish them. Without this, we shall not attain to the clearness of statement which Professor Huxley desires. Indeed, the structure of language will in itself disclose whether need has arisen for an extended vocabulary. If 'facts of consciousness,' — 'phenomena of spirit,' — are quite different from facts explained by the law of gravitation, and also from facts resulting from the activity possible to apparatus under physiological laws, we shall need to mark this difference, by additions to the language sufficient to describe mechanical action. We shall eventually find it impossible to secure clear description, or effective discussion, without a vocabulary marking the difference between matter and mind. Everything here depends upon the range of functions belonging to human life.

Actions common to all life are fitly described as 'movements' of material structure, open in some degree to external observation. These movements are observed by us through our sensory apparatus being affected by the external occurrence. Looking a little closer, under guidance of science, it appears that all visible forms of muscular activity, are dependent on internal organic action, more or less hidden from ordinary observation. There is in all organic life, an apparatus providing for sensibility and movement. Whether the life contemplated is in the sea, or in the land; whether the organism is comparatively minute, as in the insect, or bulky, as in the elephant; whether simple in structure as in the shell-fish, or elaborately

intricate as in the human body, like arrangements provide for sensibility and motion. In all cases, there is a two-sided arrangement of nerve fibres, co-ordinated in a nerve centre. The organism is acted upon through its sensibilities; it reacts through the motor apparatus. 'The primary end and object of the reception of the influences (*stimuli*) of the external world or environment, is to enable the organism to respond to these special modes of influence or stimuli.'[1] Fibres on one side provide for sensibility through contact; fibres on the other side provide for muscular movement in sympathy with the earlier nerve movement. According to the complexity of the organic structure is a complexity of correlated nerve fibres.[2]

In the human body, we find the most complex sensori-motor system, working the most elaborately detailed combination of muscles. The manifold possibilities of work belonging to the human hand itself, illustrate well the superiority of human organism. Even here intellectual superiority is already coming into view, without which the worth of the instrument at command would not appear as it does in our common occupations. We do not, however, enter upon this as yet. It is enough here that we remark the superiority of the human body to all organic existence around. Even thus, man has a unique place.

With this superiority of human organism, we need to observe the similarity in form apparent in apes, on this account named man-like apes (*Anthropoid*).

[1] *Animal Life and Intelligence*, by Professor Lloyd Morgan, p. 302.

[2] As to comparative structure and functions I have written fully in *Relations of Mind and Brain*, 3rd edition.

This outward resemblance has its counterpart in similarity of internal structure, including muscles, nerves, and brain.[1] Notwithstanding resemblance in physique, and even superiority of muscular power in some apes, marked inferiority, even in size of brain, separates this animal from man. 'There is a very striking difference in absolute mass and weight between the lowest human brain and that of the highest ape,' notwithstanding that 'a full-grown gorilla is probably nearly twice as heavy as a bosjesman.'[2]

Judged by the range of its activity, the gorilla holds a comparatively limited place in the economy of Nature. Nowhere has the animal asserted dominion; temperature has proved a barrier to its migration; with vast superiority of strength, it has not held its own against the advance of men into the tangled forests. Notwithstanding advantages of structure, the animal has never done much in the world. Its help to us is as slight as the force of its resistance. As long as we have the horse and the dog to aid us, the ape and the monkey will be treated as unworthy of consideration in the economy of life.

If such reference to animal life, taken with the suggestions of a theory of Evolution, direct attention to primeval man, and his place in Nature, it will be obvious at once that we are being led by a direct course to signs of intelligence. The traces of man's presence in the world are traces of work which cannot be attributed to animals. It is not physique, nor even mechanical labour, so much as intellect, which is con-

[1] See illustrations in *Relations of Mind and Brain*, chap. v.

[2] Huxley's *Man's Place in Nature*, p. 102.

templated when we look on arrow-heads and stone axes. At that remote period in the world's history to which our thought is now being carried, we mark a point in natural history when a little thought was worth more than well-developed muscle. Among remains examined, arrow-heads count for more than skulls, as evidence of what went on in these times. We judge by results, and when these are carefully estimated, we are ready to say with Darwin, 'primeval man practised a division of labour.'[1]

From this point, however, we are enabled better to present the contrast between mechanism and mind. It is objectively the difference between the axe and the man who wields it; so much is the man above his tools. Tested again objectively, but this time by results, it is the difference between splintered wood, and the expectation of comfort for subsequent use of it. So also do we recognise the difference between animal and man. In material language, it is the difference between muscle and tool, as the latter adds to working power. The difference does not appear in grip; but in the purpose which directs the grasp, as it formerly directed manufacture of the tool. Neither the activity of man himself, nor the material symbols of such activity, can be explained without reference to rational power. So much is suggested by discovery of arrow-heads in tumuli, that we are already finding it impossible to restrict ourselves to language applicable to material things. We need a vocabulary which includes 'thought' and 'purpose.' We cannot get along without terms applicable to things higher than flints and muscular power.

[1] *Descent of Man*, p. 50.

Still, we are in no hurry to 'cross the frontier,' and so get beyond the range of scientific teaching. Full account must be made of human organism. Recent scientific research has shed a flood of light on its embryonic life, its development, and its functions. Keeping rigidly to scientific lines for a time, we shall be able so far to contemplate the physical life alone, reserving for a later stage of inquiry all that belongs to rational life. The grand and most impressive lesson of modern biology is the unity of scheme in the structure of organism. Man is the crowning feature in this scheme, essentially a member of the one great order of organised existence, but conspicuously its leading member. Let us do justice to his place in the animal kingdom. His physical nature is built up on the single plan applicable to all organised existence. Each individual human life springs from an egg, just as in the case of lower orders of life; the first movements in the embryonic life are those of nuclei and protoplasm preparing for multiplication within the egg, just as in the history of every species of animal; the unfolding human embryo passes through similar stages of embryonic advance as those through which animals pass; by a process rigidly conforming to common law, provision is made for development of vital organs, formation of limbs, and structure of organs of special sense. When the moment of birth comes, a perfectly formed organism is ushered into being, to begin an existence more independent as a distinct individuality. What we contemplate here is organism, in its embryonic and in its infant stages. The most impressive lesson which embryology has taught us is, the general identity of plan which regulates the

formation of human organism and that of the lower animals, from the germ to the fully-developed embryo. We have always classified man as 'animal,' we have always attributed to ourselves vital organs akin to those of the lower animals; but now we know that the method of building up the human organism is that followed in building up the organism of the lower animals. The induction is complete which assigns to man his place in Nature as a constituent member of a harmonious scheme of organised existence on the earth. Nothing can be allowed to detract from the vast conception of unity of life on the earth, to which embryology has conducted us.

From this point, our representation of the characteristics of human life must begin. It follows from what has been said that the beginning is physiological. Allowing that vital organs belong to us as to the animals, their functions are the same; so it must be with the sensori-motor system; so with the special senses; and, so far, with the brain also. There is nothing new to be proclaimed in all this. We merely state the commonly received view, accepted in every age, on the evidence of ordinary observation. The important advance to be recorded has come from progress of anatomico-physiological science, disclosing internal structure and its functions. No one, indeed, ever thought of suggesting that organs and functions of special sense were fundamentally different in animals and in men. The similarity of structure and of function has all along been too obvious to give room for such a representation. So long as we speak of organism, organs and their functions are fundamentally alike in man and in animal. Whether there is in human life

more than organism remains to be seen. All that is required of us here is to make account of structural diversity, specially as this may appear in terminal arrangements for organs of special sense. There is close resemblance in embryological development, and again in the functions of the mature life. Yet each germ-cell, though unfolding through analogous forms, develops the life of the species to which it belongs. At the moment of birth, the distinctive species is manifest. In the activity which thenceforth begins, analogous functions, and distinctive functions, are readily recognised. The functions of the vital organs, of respiration, digestion, circulation; the functions of the sensori-motor system; the functions of the special senses, touch, smell, taste, hearing, and sight; the functions of the brain in receiving and transmitting excitation, are fundamentally analogous. At the same time, the specialities of the human species appear in the infant, coming more clearly in view as infant life unfolds. All this concerns a physical life. Here, therefore, it is sufficient to employ language applicable to material existence, for we refer exclusively to physical organs and physical functions. Let us remember, that organism is, strictly speaking, a constructed machine, with apparatus adapted to secure certain ends. When it is added that the machine is in all cases constructed on a common plan, it is obvious that this is natural if the several organisms are to accomplish common ends. This conclusion is sure, the human body is constructed on a common plan applicable to animal life. From the first movement in the fertilised egg, onwards to the date of birth, the human organism passes through

stages of development analogous with those of embryonic life in other animals; but reaches a more advanced condition.

From infancy to maturity, it is different. The unfolding of life discovers a new and distinctive order of functions, from which we infer a new order of powers, of which no account appears in embryology, or even in the physiology of the mature life. The first stage of development in infancy is entirely physical, quite explicable physiologically, and capable of being expressed in terms applicable to material existence. The only thing to be remarked is, that the child is much slower in the exercise of the functions of the special senses. In sight and movement, a chick is at first vastly quicker than a child. The reverse appears later. As development progresses, the barn-door fowl increases in size, gains in muscle and strength, but does not exercise sight functions more than at first. For the fowl, food, corn-pickles, flies, and objects around may stand for the *maximum visibile*. For the child, as for the chick, birth is the beginning of new conditions of nutriment, along with which there is scope for freer muscular activity. Beyond this, the difference is remarkable. The similarity observed in the embryonic life continues in the unfolding physical life. But a later stage of development in the life of the child introduces phenomena altogether singular. These belong to the visible dawn of intelligence. This comes considerably after the date of birth, when analogies of animal life are being left behind. A higher life, with new functions, begins to show itself. From this point, a new development proceeds under new conditions. Thought, not

nutriment, now becomes the leading condition for development; not knowledge apart from nutriment, certainly; but knowledge as additional to nutriment. Knowledge is the nutriment of a higher *life*. Even the young child has a larger place in Nature than the fully-developed animal. Why does the child drive the cow, why does the cow not drive off the child? How can a boy so early guide a horse?

Let us now keep as closely as possible to the line of development in human life. The most important facts will be found all along this line of observation. The opening stage of infant development is exclusively physical; it is the progress of organism, in adaptation to new conditions. We are wont to describe it as the period of unconscious life. The dawn of intelligence, of which we have spoken, marks a second and greatly advanced stage. We also name it 'dawn of consciousness,' distinguishing between self and not-self. I fear it must here be confessed that our language is not such as can be applied to material movement. Accordingly, we find it natural to begin enlarging our vocabulary, for we must speak of observing, of directing the attention, and of reasoning. How can we any longer speak only of bodily movements, or use language applicable to these? We are here concerned with the dawn of intelligence itself. A true natural history of human life is dependent on accuracy of description here. We are parting from physiology, we are 'crossing the frontier,'—we are reaching the point where it has become needful 'to guard against mixing two methods.' We can discriminate as we now do, only by the aid of our own experiences, never in the smallest degree by the aid

of scientific methods. Here, as Professor Burdon Sanderson has said,[1] homage must be rendered by physiologists to investigations lying 'outside the limits of their science.' Homage to 'divine philosophy' is in some sense homage to the dawn of consciousness in the child.

What is meant by this dawn of consciousness can be understood only by what we ourselves know of consciousness. We have no recollection of such dawn in personal history. What we profess to recognise occurring in infant life, is alleged to bear the description given to it, only on the ground of the activity belonging to ourselves at every moment of our experience. We know what self-consciousness is, and we remark external signs of its beginning in the life of the infant. From this slight beginning in the young life, we can find signs of the unfolding of conscious life, first in 'attention,' with its attendant varying expression on the countenance; next, in movement, specially in the outstretching of the hand towards visible objects, as their nearness is recognised; and, by and by, in speech, which opens the channels for communication. The signs which were at first only visible, are now confirmed by audible expression,[2] for the 'facts of consciousness.' The life is not separated from material existence, but is clearly dependent on physical apparatus and on material media, for observations and communications. But apparatus and media are here holding a secondary place, as only auxiliary; observations and communi-

[1] *See* p. 37.

[2] What is it to a mother when her child proves unable to articulate! To what a variety of contrivances does such a trial lead!

cations are the primary phenomena, peculiar to man. Pursuing this line of inquiry, we shall find the characteristics of human life opening out before us, in a manner making it quite incongruous to speak of 'animal life.'

Let us take 'observation,' the accredited instrument of science, and we shall see how 'truth' is attained,—how 'knowledge' becomes nutriment for a higher life,—how the observations of the child are the precursors of those of the scientific man,—how truly simple observation is the opening stage in the course of development belonging to a rational life. Observation somehow widens out into knowledge of difference and of distance; and, a little further in advance, it leads to interpretation of sensory experience. This is the large meaning we are assigning to observation, as we describe the functions belonging to the life of a child. It involves from a very early period notice of difference, not as the hand or the eye experiences successive impressions, but as differences are brought into contrast, and a hold is kept of distinctions, making them the beginnings of a knowledge of the external world, and more slowly of a knowledge of self. From this stage, external objects and occurrences are full of interest, and 'I,' in the midst becomes conspicuous as a centre of thought and of action.

Henceforth, organism and intellect co-operate; these are the conditions of progress within the single life; not the one, without the other; neither organism without intellect, nor intellect without organism; but both in essential correlation. Good food will not develop a human life, yet such a life will not be developed without food; but, knowledge by difference

is in some respect even more essential for development of this young human life. Lack of the one may bring death; lack of the other will bring stagnation of life, even while life endures,—presenting a life checked and cramped in development. Fit nourishment, and healthy action of both organism and intellect, are the conditions for development of the human being. There is great contrast between these two sets of conditions, pointing to contrast in functions; but however contrasted, they are invariably and intimately related in the normal life of man. Each set waits on the other, and attends on the other, in order that activity may widen out in accordance with the laws of development. The one set cannot be sacrificed to the advantage of the other. A life physical and a life intellectual, acting in unison, together supply the conditions of a healthy human life. There is manifest fitness to the powers and possibilities of this type of life, when there is adequate provision for physical exercise and rest, and at the same time, scope for increasing intellectual activity. This is the rule of human existence, important for old and young alike. Throughout early life there is a great contrast between poor food, and poor education; in after life, there appears a large contrast in comparative results.

Until we have set the two sides of our nature in contrast, we cannot fully appreciate the complexity of human functions. The correlation and coherence are unmistakable; the antithesis must be seen and understood, if we are to appreciate the conditions of our life. Physique has not its equivalent in intellectual force, any more than intellect has its equivalent in

physique. The solidarity of life is certain; mind and brain stand in fixed relations; but the difference between the two, arising out of their distinction, is one of the things most obvious in human history. Robustness has not always an intellectual equivalent; rational insight has not its physical counterpart. Even a well-developed brain is not the exclusive possession of those remarkable for intellectual gift; its existence is not an assurance for manifestation of high intellectual functions. Nutriment will not develop mind; it cannot take the place of education. Yet so surely is there some natural correlation between physical and mental life, that poor food is a hindrance to intellectual advance; though we are unable to claim that high living is a security for high intellectual effort.

From the dawn of consciousness, we pass to a more advanced period when we mark the beginnings of self-directed life. We are not here fixing any date; we are recording the appearance of a new order of facts, in the unfolding of life. Concentrated observation and reflection prepare the way for *self-directed activity*, whose outcome is 'rational conduct.' The same rational power here continues at work, but on a broader basis, and fulfilling a new function in the government of activity. Regulation of conduct appears in a manner altogether new, standing in full contrast with animal activity. There is no longer need for modifying the statement of contrast by reference to participation in the functions by the higher animals. It is, however, of essential moment for the argument that the statement of facts here should be clear and complete. A distinct phase

of life is before us, which it is easy to depict, because it is familiar to us all, while it is peculiar to human life. We have to make clear the rational procedure, which is the pre-requisite for action, and the personal activity which results from it. This can be accomplished without entanglement in matters of controversy. The rational power at work is the same which has been concerned in the ingathering of knowledge, and in the interpretation of occurrences. A wider rational basis, however, appears now, in the recognition of laws of right conduct. How this knowledge of ethical law has been reached, need not be discussed. Enlarged scope of action for the rational power is seen in the application of laws of moral life for decision as to right conduct. In consequence, we have in rational life the conception of duty. A further consequence is, judgment upon past action as right or wrong. Still later in experience, arises a sentiment of self-approval, or of self-reproach. These are characteristics of 'personal life.' Every reader is a competent judge of the accuracy of this account of our moral life. If accurate, the scientific importance of the facts enumerated is unquestionable. These facts must present the severest test which a theory of Evolution has to encounter. The conditions of action are changed when rational self-direction comes into view. This change is so great as to amount to a complete contrast with all that has appeared in lower forms of life. Passion and appetite have not disappeared: they are present as before; but instead of determining conduct, a new exercise of power has appeared to control them. Life has here a duality within it, which has not been seen at any lower stage. Life's history becomes in this

way a history of conflict, of which no trace has appeared at any earlier point in natural history. The struggle between individuals has not disappeared, but a struggle within the individual life occurs, which has never been visible in the history of any inferior order of life.

A new problem now arises, an urgent practical problem for the individual, destined by and by to give complexity to the scientific problem. The duality remarked, sets the physical in some degree over against the rational. This is the key to the struggle in the life of the individual. Physical movement has its own origin, and its distinct measurable force. The rational movement has its origin quite independently of the physical. Contact with external objects, sensory experience, muscular power, opportunity for action, remain in all respects as with the animal. But thought has a growing power in the history of human activity which has now become complex, by intermixture of physical and rational exercise. There is one life, but a duality of power within it; one continuous course of activity, but a duality within that also. The physical precedes the mental; and again, the mental precedes the physical. The conditions of activity are thus greatly enlarged in human life, and that by appearance of a new and higher power; not a mere adjunct expanding to greater amplitude the power already working, but power which takes control of that already acting, and this to such a degree as in many cases to check, and greatly to restrain, appetite and passion. Human experience cannot be described in terms of less complexity, such as expansion of sensibility, or increased variety in the

phases of sensibility. There is an obvious dualism. Distinct phases of action appear, each having a distinct origin, the one outer, the other inner. The physical does not originate the mental; nor does the mental originate the physical.

The facts enumerated are so familiar, and so universally recognised, that the brevity of the foregoing description will not be subject of complaint with the reader. We have restricted ourselves to the briefest record of facts, guarding against introduction of theoretic controversy. To give vividness to this description, take human work for illustration, as admitting of ready contrast with animal work. In the work done by a man three things are distinguished, intelligence, vital apparatus belonging to organism, and tools employed. Intelligence rules the other two, thereby determining the value of the work done. Intelligence in a sense passes into the muscles, and even into the tools, in order to gain a contemplated result. Improved tools are not even tools for us until we understand how to use them. Harness placed on the horse is the product of human work; 'horse-power' is only power of muscle, (its equivalent finding expression in engines); horse intelligence suffices only for receiving directions from the driver. Brain, nerves, and muscles belong to the horse; without them he could not do his work; but these do not account for accomplishment of the driver's purpose. If they did, drivers would be dispensed with, because of the cost of labour.

The difference between the tools of prehistoric times, and our most recent inventions, indicates the extent to which rational power has been concentrated

on construction of mechanical appliances. This is the difference between polished stone for an arrow- or axe-head, and the modern steam-hammer and telegraphic apparatus. Thought has brought greater mechanical force to our aid, turning even the forces of Nature into service, making less demand on muscular activity, in order to have freer egress for human purpose. This is the distinctive feature in industrial advance. It is thought against muscle; the outcome shows greater results by improved instruments. These few illustrations of the part played in the world by rational power may suffice.

We are now prepared for comparative results, in the first instance, in view of man's relation to the animals most associated with him; and next in view of the distinction in his own life between functions physical and rational, expressing the dualism noted in his life. We seek reliable classification of the functions, without as yet touching the theoretic question as to the origin of the differences observed.

The warrant for classifying man with animals is clear. Human organism belongs in all respects to the system of organic life, moulded on the same plan, subject to the same laws of health, liable to the same diseases, endowed with analogous sensibilities and powers of locomotion. A man depends upon food, air, and exercise, just as a dog does. In all organism alike, there is tear and wear, as with machinery; in all, combustion by effort; in all, need for renewal of energy by nutriment. Physical energy, and physical work, are strictly analogous through all Nature. Distribution of life over the globe shows adaptation to

environment, but no deviation either from the general plan of structure, or from the laws of sensori-motor activity.

Differences in the functions of animal life depend on differences of structure, involving differences in working apparatus. Capacity of sensory impression, and power of muscular activity, are common to all. For these, there is a common dependence on brain and nerve, all nerve fibres being co-ordinated in a nerve centre. Nerve centres are more or less complicated as differentiation of bodily structure is extended. The more elaborate the bodily differentiation, the more elaborate the nerve distribution and the more complicated the central arrangements. Only in this way is diversity of function provided for in the animal structure. Functions depend upon structure. As these are multiplied, there is variation in terminal organs of sensibility, and increased complication in muscular arrangements. Special senses are only modifications of the sense of touch; detailed muscular distribution answers to all diversities in sensibility.[1] In this way, a definite conclusion is reached as to man's physical nature, in accordance with the inductions of comparative anatomy and physiology. The superiority of human organism appears in its structure, not in the conditions under which its functions are fulfilled. In the scale of organic life, Man holds conspicuously the chief place; in the line of history, his appearance must be accounted for in accordance with his rank. His superiority in organism is altogether impressive, as indicated by comparative size and weight of brain, by complexity of structure

[1] I have discussed details in *The Relations of the Mind and Brain.*

within the brain, and by variety of sensitive capacity and of motor power. His superiority is not so conspicuous in muscular power, as it is in sensibility, serviceable to rational intelligence. Reliable guidance for comparative results is found in structure, not in external form. On this account, comparison between the ape and man, presenting resemblance striking to the eye, and available for pictorial representation, is far from supplying evidence of the approximation of the two orders of life. Comparisons, founded on internal structure, are not by any means so suggestive of affinity. It may be fortunate in many ways that we have been liberally supplied with pictorial representations of the ape, for Zoological gardens find great difficulty in presenting living specimens. The 'Anthropoid' does not promise well for the future. As to comparative structure, there is accessible guidance in Huxley's well-known work, *Man's Place in Nature*, where the main facts are given. Let us present the resemblances and contrasts, keeping comparative intelligence for the present out of view. When internal structure is the test, in what is the ape more like to man, than the dog? Is it not mainly in form? The vital organs are analogous; differentiation in the muscular system is as great in the one as in the other. The dog is at least equal to the ape in the general sensory system, and is superior in sense of smell; the brain is well-nigh as elaborate in the dog as in the ape. Science has not demonstrated great structural superiority for the ape. The form of body is more like to that of man, and so in consequence is the *form* of brain; but, when comparative structure is considered, a plea for superiority of the ape cannot

be sustained. A claim for the ape, warranting a much higher place in the scale of organism, would require us to indicate functions of the one life which are not performed as well in the life of the other. There is considerable contrast in posture, and in locomotion, as in the life of an animal constantly climbing trees, (squirrel, monkey, or ape), compared with that of an animal of similar structure, but habitually moving on the surface of the ground.

Let us next take comparative structure of ape and man. In what respects, apart from form, is the ape inferior to man? In everything in internal structure and in function, in which the dog is inferior. In what is the ape superior? Only in muscular power. Notwithstanding this superiority, in which many animals equal the ape, the brain of the lowest savage of the human family is in structure greatly in advance of the highest ape.[1] In man, there is inferior muscular proportions with superior brain; in the ape, superior muscular power with inferior brain. A theory of 'natural selection by accumulation of slight modifications of structure' has a clear answer as to the origin of the difference in form between the ape and the dog; but the theory has no such clear answer as to the origin of the difference of intelligence between the ape and man.

In the field of comparative research, the rational life of man is the outstanding event for which there is no adequate scientific explanation. The perplexity for the theory of 'natural selection' is that anatomical structure and physiological law, fail to provide for the higher functions. Hitherto, we have been able to trace

[1] Huxley's *Man's Place in Nature*, p. 102.

functions to organic structure. By penetrating into minutest details of structure, watching with microscopic aid the faintest movements, and recording, by help of the finest instruments, speed and volume of movement, physiological science has placed beyond question the relations of structure and function.[1] But we are now reaching a point where the light fails, where the voice is silent. Looking at life, as it is concerned with knowledge, apart from muscular activity, we have come to a knowledge, which cannot be attributed to the sensory system, any more than it can be attributed to the motor system. Research into brain structure carries no explanation. Our nerves can no more explain its origin, than our muscles can. Physiology never has made any account of human knowledge, not finding in physical structure and function anything promising help as to its acquisition. Research into brain structure has not helped us towards identification of the source of physical science.

Localisation of function in the brain has made large advance. Centres of sensibility have been identified, so also have motor centres; and even centres for vocalisation, providing for the language of dogs and of monkeys, as well as of men. But there has been no advance towards localising of 'thought centres,' such as might produce science. It is true, and to be specially noted here, that electric excitation of brain has failed to find the functions of certain silent' portions of the brain, but these 'silent regions' are found in the brains of lower animals also, and to

[1] See Beale's *Idioplasm.* Ferrier's *Functions of the Brain.* M'Kendrick's *Life in Motion.*

none of the animals have we attributed high rationalising powers.

In marking here the limits of physiological discovery, it will be observed that we are seeking only localisation of functions; we are not dealing with the natural history of their appearance. At this stage, I do no more than remark as a notable fact that science has not localised reflective procedure. On questions of comparative intelligence, involving differences between animal life and human, I do not enter now. These will come in due course. From study of our own rational power, we shall be better able hereafter to contemplate animal intelligence. Our single conclusion here is, that conspicuous phases of ordinary human activity have not been proved to lie within range of physiology. The phenomena of sensibility and of motor activity have been localised in the brain; the phenomena of rational life have not been so localised. Science thus leaves the way open for our inquiry, whether rational phenomena altogether transcend the functions of organism. The need for dealing with this problem is not affected by the admission that brain is the organ of mind. This position gives force to the rational demand here indicated. Looking at the natural history of human life, Darwin has said: 'As the various mental faculties gradually developed themselves, the brain would almost certainly become larger.'[1] This seems to me perfectly certain, under the law that use favours development. But the statement presupposes mind in active exercise, and brain as an organ directed in functional activity by a power superior to itself. The

[1] *Descent of Man*, p. 54.

enlarging of brain does not produce 'mental faculties'; but the working of mental faculties leads to enlargement of brain. The line of evidence gives way at a point critical for the theory.

The whole wide circumference of rational experience and effort, now stretches before us, — outstretching nerve sensibility, and nerve control centred in the brain,—the distinctive characteristic of human life comes fully into view. We have seen how closely allied with all animal life human organism is; we are now to see how widely severed from all animal life,—how completely exalted above it all,—is the life which is distinctively human. We have now lying before us phenomena which can by no means be attributed to organism, yet belonging to the ordinary human life. Rational interpretation of sensory experience marks the line of separation here; and from this all distinctively human activity opens out. Here we enter upon a field of activity so vast, that its possibilities seem endless. Diversities appearing in this region of activity are completely beyond those variations occurring in animal life, which have supplied data for Darwin's theory. A remarkable difference in scientific classification here becomes apparent. On the physical side, variations lead to new species; on the mental side, variations warrant no such distinctive classifications. Rational life is one, whatever its variations, and this because rational power is the basis for the life, however extensive the variations. Physiological differences are insufficient to disturb this evidence for the unity of the race. The contrast between physical life and rational, thus becomes very marked. Variations in colour of the skin, in character

of the hair, in facial expression, in measurements of the skull, in evolutions of the brain, numerous as these prove to be, are not such as to warrant classification of new species. Transfer observation to the rational life. Variations are here incalculably more numerous, and yet in the midst of them the identity of the rational power is manifest. Animal variations may lead to origin of species. Mental differences, even greater in range, do not break the unity of the race. We are now contemplating a single order of life spread all the world over, the laws of whose development are different from those applicable to lower orders of life.

All the characteristics of this higher life unfold from the rational exercise which concerns itself at once with interpretation of sensory experience, and regulation of personal conduct. Everything belonging to the reflective exercise, to acquisition of skill, to division of labour, to cultivation of art, to exercise of literary gift, and to formation of moral character, unfolds from the simplest stage of rational exercise. The line is clear,—and it is a single line, from such a starting-point as this,—leading all men onwards to the ultimate problem of metaphysic, the problem of the Universe itself. For the humblest thinkers, and for the greatest thinkers which science and philosophy claim, the conditions of thinking are the same. Accordingly, it holds true, to a degree quite marvellous in view of the great diversity in gifts and attainments, that the problems raised are identical. These facts present the evidence that rational life is essentially one, with no such grounds of severance as mark off diverse species of organic life.

The facts thus briefly touched are so familiar that there is no need for entering upon detailed illustration. The contrasts between organic and rational life become more vivid as they are contemplated. In organism, there is sensibility to contact at every point on its surface, response along all the muscles, and dominion of animal appetite, having for its end satisfaction of animal want. This life has its centre in the brain. Quite beyond all this, known to us only in consciousness, is the life of reflection. Within this sphere of higher activity, differences of experience are observed and compared, conceptions of objects are formed, inferences are drawn, purposes are shaped, and the task of self-government is carried on under guidance of a standard of right conduct. These are functions of mind. So far as relation to the external is concerned, whether for knowledge or for action, brain is the instrument through which mind works, but not wittingly, not by conscious use of the instrument. Intelligence only accepts sensations; apart from physiological action, it forms its own volitions.

The chief differences of faculty among men are the different measures in which intellectual power appears in their work. Whether we estimate their lives by reference to what the men are; or by differences in their efforts; or by the value of their contribution to a general result, the contrast lies in this—the extent to which thought goes into the guidance of effort. Within consciousness are included ordinary understanding, observation of methods, skilful device, intelligent use of appliances, and knowledge of laws and principles. A man must know his powers, know his work, and put his best into it. This holds for work

of all kinds. The artist will say wisely: 'I fall back on this truth, that, after all, the greatest thing about a picture is its conception—the thought of it.'[1] Man is master of action and of circumstances, as the animal never is. This Socrates taught, long years before the Christian era, when he urged his lesson, 'Know thyself.' This Carlyle also saw and said, even when in his own scornful way he was protesting against the Socratic maxim, and at the same time proclaiming that there are depths in human nature lying far beyond reach of our sounding-lines. '"Know thyself!" long enough has that poor "self" of thine tormented thee; thou wilt never get to "know" it, I believe! Think it not thy business, this of knowing thyself. Thou art an unknowable individual; know what thou canst work at, and work at it like a Hercules. That will be thy better plan. It has been written, "an endless significance lies in work"; a man perfects himself by working.'[2] Even the common knowledge of ourselves implied in direction of our daily conduct, may suffice to guard against the fallacy of interpreting man's work by reference exclusively to the functions of organism. Organism is mechanism; man is more than a machine. Even if our greatest happiness be made the basis of preference, it requires a conception of our good on the whole, if we are to gain it. Hence the force of J. S. Mill's words: 'It is better to be Socrates dissatisfied than a pig satisfied.'[3] Food, drink, and sleep do not include the requirements of our life; do not provide for its enjoyment; do not

[1] *Life and Letters of James Smetham*, p. 128.
[2] *Past and Present*, Bk. III. ch. xi.
[3] *Utilitarianism*, p. 11.

suffice for accomplishment of what Aristotle described as the true 'work of man,' energy according to reason.[1] Human conduct includes more than the management of our muscles. Knowledge means more than records of sensible experience; more than reaches us through our open eyes. 'Right' points to sovereign law for man, with large range for thought as to its varied application. The conception of 'the right' supplies impulse for all the nations, carrying direction for them all in government and in advance of civilisation. 'The right' implies constant reference to the supernatural, giving force to the counsel,

> 'At noon in the bustle of man's worktime
> Greet the unseen with a cheer.'[2]

From these few obvious tests, it will appear that our life includes much beyond the functions of organism. 'The man who appreciates his position in Nature will give its proper place, among the prime necessities of human well-being, to the internal culture of the individual.'[3] We thus recognise the difference between a strong man and a wise, claiming that wisdom is more than strength; is, indeed, the true strength of a man. Strength secured by nutriment is very different from strength of thought. Man's place in Nature is determined by his rational life. For a scientific theory we need a much deeper appreciation of the functions of rational intelligence than can be had even by interpretation of its ordinary use. We need a science of intelligence equal to our modern physiology. The knowledge of organic structure supplied by the science of our day, shows it to be marvellous beyond the utmost

[1] *Nicom. Ethics*, Bk. I. ch. vii. [2] Browning's *Asolando*.
[3] *Autobiography* of J. S. Mill, p. 143.

conjectures of previous ages. At the same time, it is impossible to explain man's achievement by reference to his physical superiority. Intelligence alone makes him master; yet must he master himself, in order to be master in Nature. Otherwise, he may live in base slavery to passion, in comparison with which the subjection of animals is reasonable service.

Without entering into minute detail here, we include in this general account of the functions of rational life comparison of objects, discrimination of qualities, their classification under common names, formation of images of things by mental inclusion of common qualities, formation of abstract conceptions, inductions of the laws of Nature, and recognition of general maxims of conduct. This is such an enumeration as any man would make, including as it does exercises with which we are familiar in everyday life. We thus set in position those functions of human life which a theory of Evolution must include.

Alongside of this let us place Professor Huxley's enumeration in terms applicable to organic life. 'In physiological language . . . all the multifarious and complicated activities of man are comprehensible under three categories. Either they are immediately directed towards the maintenance and development of the body, or they effect transitory changes in the relative positions of parts of the body, or they tend towards the continuance of the species. Even those manifestations of intellect, of feeling, and of will, which we rightly name the higher faculties, are not excluded from this classification, inasmuch as to every one but the subject of them they are known only as transitory changes in the relative positions of

parts of the body.'[1] Thus, adherence to 'physiological language' illustrates its insufficiency. It is impossible to comprehend 'all the multifarious and complicated activities of man' under these three categories,—maintenance of the body, bodily movements, and propagation of the species. If 'the manifestation of the higher faculties' is not excluded, still the faculties are unexplained. The main characteristics of mental activity are even excluded from view. Mental actions are known in consciousness. But for this knowledge of them, we could not regard bodily movements as their 'manifestations.' Besides, only a small proportion of these exercises manifest themselves in 'transitory changes in the relative positions of parts of the body.' On the other hand, mental exercises are known as distinct from our physical movements, even when the physical are 'manifestations' of the mental. In human activity, dualism of function is complete; unity of life is sure. The difference in nature of the body and of the soul is apparent in the characteristics of their activity. The modes in which these actions are known are distinct. In external observation, the bodily activities are known, the mental are unknown, as Professor Huxley says. In consciousness the mental activities are known, the bodily are unknown. Conscious intelligence provides for the unification of activity. While human life, in common with all organic life, is subject to physical conditions, it has this distinctive characteristic, that its regulation as a whole is that of a conscious rational agent. Organism only belongs to it, does not include the centre of vital activity.

[1] *Lay Sermons*, p. 135.

CHAPTER IV

THE RELATIONS OF ENVIRONMENT TO LIFE

In attempting to secure a full statement of the phenomena of life, external conditions are best taken separately. Turning now to environment, our aim will be to consider what diversity appears here, because of the contrast between rational life and animal. The relations of humanity to all else that appears in Nature are so many, as to demand an enlarged interpretation of 'environment.' For the life of an animal, environment has a restricted area. Inductions in natural history have been limited accordingly. For human life, environment means something largely beyond what has been commonly included. This difference does not arise from any change in the physical conditions of life, any more than in its physical basis. The conclusive evidence for continuity of plan, up the whole scale of organism, greatly increases the significance of the difference now to be noted in relation to environment. Air, light, heat, and nutriment are necessaries of life for man, as for animals. Every induction fairly drawn from these conditions is applicable to human life; but humanity spreads out over the face of the earth, to find a larger and freer life than belongs to any of the animals.

Animals in their natural state are only consumers, or, at best, and in only a few cases, storers of supplies. Man is a producer. The formula of life's relation to environment must be altered accordingly. Besides this, man has wants which no animal shares. Environment proves equal to his enlarged demands, and even stimulates new desires, as if Nature herself must have suffered neglect,—must have failed to find application for her abundance,—if rational life had not appeared. But for this life, the buried treasures would have lain concealed throughout the ages; beauty adorning the landscapes would have had restricted value, for lack of emotion to be stirred by its contemplation.

Inferences based on food-supply now either become inapplicable, or require to be greatly modified in the form of their statement. When we reckon up 'the necessaries' of life, we do not now think of a patch of cultivated ground around a homestead. The wide world has become the area of supply. Men in remote parts share the fruits of the earth's richest orchards and vineyards. 'The struggle for existence' is conspicuous enough in the history of men, but it is encountered under conditions different from those applicable to lower orders of life. Difficulties which tell sorely against animal life, disappear before human effort; difficulties which oppress mankind, are imperceptible to animals.

Let us begin with what is common to organic life, the better to distinguish afterwards what is special to humanity. In all cases, the history of life is a history of the interaction of organism and environment. Bare life is insufficient to work out a history for itself. Life

must have its nutriment, space for movement, and conditions under which it can seek satisfaction. Without these, life must disappear. In the history of vegetable life, dependence on environment is at its maximum, supplies being drawn from a comparatively limited area. Animal life moves over a considerable space, competing for existing supplies. Everywhere in Nature, animal life has its work prescribed by pressure of physical wants. In remote depths of the forest, rarely resounding to the footsteps of men, and in the great wilderness, the pressure is felt. Here is the symbol of the common conditions of life,—unceasing toil to provide for life's wants, to ward off life's dangers. Not always by co-operation, as in insect life, are supplies found; more commonly by individual struggle for ascendency over others of the same species, and by destruction of lower species. It is with most animals, as with the fishes in a stream, where the largest are in advance taking the food most attractive, the others having what is left. In the history of rational life, there is productive power, multiplying supplies, and providing for distribution of commodities. The common conditions of life are not withdrawn or altered, so far as dependence on nutriment is concerned; but new conditions of supply are superadded. Man sows and reaps, toils and gathers. Multiplication of the fruits of the earth, and increase of flocks and herds, provide for extension of food-supply, whilst facilities of transit prove of such value, that a railroad may deliver from famine.

More exact formulæ are needed, if these differences are to be rightly estimated, as bearing on a theory of natural history. Animal life has its experience

determined by its sensibility, muscular activity, and fixed environment. Rational life lifts the physical into new relations, by multiplication of supplies, and largely creates its own environment by regard to possibilities of increase under the laws of Nature. Search, struggle, and consequently the 'survival of the fittest,' are characteristic of animal life. Supply is limited; craving rules; and, unwittingly to the animals, advance in organic life results. Rational life is not severed from physical need; but the laws of Nature are so interpreted and applied as to modify the conditions. While this remains possible, Nature's supplies steadily grow, to meet advancing demands, even though limits of production are clearly within sight. Supply is no longer restricted to what an urgent appetite finds ready to hand; but is prepared for, produced, and gathered in. Man toils, and waits, and at times, is rewarded with a hundred-fold. Soil and seeds, implements of handicraft, and machinery for working up raw material, are only primary forms in which, by anticipation, we express food and clothing. The most dependent form of organism, being linked with a rational life, becomes the least dependent.' The highest life meets life's demands by forethought and effort. This gives a new aspect to natural history, which must greatly modify the theoretic significance of 'the struggle for existence,' as it bears on the general problem of life on the earth.

The appearance of rational life has so widely affected the natural history of the earth, as to tell largely on the lower forms of life. Human life maintains its position all over the world. As man's

influence extends, the struggle for existence meets a check previously unknown. Development of life takes new directions, under a guiding power which is the main factor in determining results. Only by making full account of man's work, can we have a completed theory of the evolution of life on the earth.

Man largely modifies, and even makes, his own environment. In the history of human effort, society itself becomes an organisation in which personal rights are sustained and vindicated. Under co-operation in industrial enterprise, and in the government of civil life, 'environment' begins to wear a variety of aspects. For lower forms of life, environment proves a dominating force controlling vital movement. Without it, the seed were only a lifeless thing, dry as a particle of sand. Hence the prominence of environment in the literature of Evolution. On the other hand, it is equally clear, as Eimer has admirably maintained, in pleading for modification of theoretic teaching as to environment, that evolution proceeds 'according to the laws of organic growth.'[1] While there is no exception to the law of dependence of life on outward conditions, it is equally clear that the laws of organic growth are such as to favour advancing development. There is double action disclosed, when we speak of the potency of environment and of the inherent energy of life. Life itself is the moving power. Environment only fixes the conditions which vital movement encounters, and to which it must adapt itself. Neither does life account for environment, nor en-

[1] *Organic Evolution as the Result of the Inheritance of Acquired Characters*, by Professor Eimer, of Tübingen.

vironment account for life. By logical necessity, our thought must get behind both, for an explanation of Nature.

We may indeed speak—in a sense we must speak—of the 'action' of environment, as we do of the action of life; but the term is used in quite different senses in these two cases. Life is greater than its surroundings, however dependent upon them. 'Nature,' regarded as distinct from life, is, at best, a mere unproductive wilderness. Environment as a separate entity is an impossible conception; life is in the midst. Thus is our definition of 'environment' constantly shifting, for as we rise in the scale, environment of life includes even the lower forms of life on which the higher life feeds. Whatever is yet to be said as to efficient causes in Nature, the causality of life itself wears quite different aspects, according as the life considered is organic or rational. That a certain mastery belongs to environment, even human history is ever testifying; but this mastery yields, before the powers of the rational agent. By interpretation of Nature's laws, man makes a new use of Nature's supplies. He reads the laws of supply, in the form of inductions as to Nature's potentialities. Thus he has steadily extended his hold on possessions, multiplying comforts and advantages, notwithstanding all the evils which cling to our individual and our social life.

Still, Nature invariably makes large demands upon effort, for satisfaction of life's wants. Beyond this, Nature exacts much even in distribution of her gifts. While a superabundance of life is provided, much of it is sacrificed as an essential condition for general

advance. In one view, the development of life appears as an end; in another, a vast amount of life on the earth appears only as a means to that end; and not until the responsible rational life is contemplated, can we speak of life which is an end in itself, never to be used as a means to an end—not even under a law of self-sacrifice. Yet so great is the struggle everywhere apparent, that the life which survives, works out its deliverance by a supreme effort. How large is the reading of this law, we are not yet in a position to make out. Manifestly, however, sacrifice of life is greater, the lower the life is in the scale of being; the higher life advances, the more fully is its preservation secured. In the case of human life, the law of its preservation has assumed even ethical form. Keeping these differences fully in view, the law of conflict, affecting the history of life itself, remains conspicuous. With large advantage for our knowledge of the laws of Nature, has general attention been turned by Darwin on the struggle for existence. A fuller understanding of the exactions of Nature, has given a deeper knowledge of the possibilities of organic development. The harvest of life has become more varied and rich to our view, as the result of a wider range of vision. 'Struggle for existence' was antecedent by long ages to man's cultivation of the field; and harvest had succeeded harvest in more remote times, as they have in times more recent. Silent ages had been fruitful in ever-increasing measure, before the epoch came when man lifted up his tools on the earth. Ever since that epoch, the noise of his work has waxed louder and louder. While lower life still flourishes in the

solitudes and in the silent regions of Nature, man goes along the noisy highway, bent on new achievements.

The secrets of Nature are being incessantly transferred to the records of science. Nevertheless, the more we know, the more impressive becomes the region of the unknown. When the origin of the individual life has been discovered in the germ-cell, it is through recesses of the unknown that there comes at length the familiar form. Concentration on lower phases of life, has largely expanded our conceptions of the whole system of life. To the scientific spirit, the unknown must ever have an alluring power. Without sense of this, the true value of our inheritance of knowledge cannot be estimated. The known has its attraction, only as it stands over against the unknown—the sealed treasury of a future inheritance.

Hence negative positions help to our understanding of positive. The restrictions of environment show the potency of living growth. Life's power of adaptation to external demands, becomes increasingly surprising, as the researches of natural history are continued. The quiet life, long since vanished from its place in the earth, has left its testimony in the face of the living. Rational intelligence can read it there, as plainly as it reads the printed page. Life's power of adaptation now stands an accepted truth, ever coming out more clearly to view, as we see life itself in relation to the background which Nature supplies. As action and reaction advance, a higher life appears; and with this, much of life itself is thrown into the background of environment, providing for life's need. Organic advance carries larger variety into the orders of life.

The lower life, being the more abundantly produced, is also largely sacrificed for the sake of the higher.

Domestication of animals has brought to focus varieties of evidence guiding to scientific conclusions. The facts so utilised, being generally familiar, need not have extended reference. Some special line of scientific observation may best serve requirements. Let us take the changes occurring in 'the young stage of some osseous fishes,' as those were traced by Agassiz. His observations include changes in the structure of flat fishes, changes in the tail, in development of pigment cells, and transposition of an eye from one side of the head to the other. These are incidents in the adaptation of the young of flat fishes to the modes of life peculiar to the species at a later stage. The change of situation of the eye will strikingly illustrate the power of adaptation claimed for all life. Young flounders first swim vertically, as most fishes do, and only after a time turn over on their side. 'While still in the egg, and for some time after hatching, the eyes of the two sides are placed symmetrically on each side of the longitudinal axis.' The change of position of one of the eyes, so as to place both on what is to be the upper side, is effected 'very early in life,' while all the facial bones of the skull are still cartilagenous. The first change of position of the eye to be transferred is its slight advance towards the snout; this is soon followed by 'a slight movement of rotation.' When the young fish is seen in profile, 'the eye on the blind side is now slightly above and in advance of that on the coloured side. With increasing age, the eye on the blind side rises higher and higher towards the median

longitudinal line of the head, a larger and larger part of the eye becoming visible from the coloured side, when the embryo is seen in profile, until the eye of the blind side has, for all practical purposes, passed over to the coloured side.' After this change has occurred, the dorsal fin 'extends along the head towards the nostrils,' 'thus finding its way behind the eye which has come from the blind side,' as if preventing return of the eye to the normal position. These evidences of adaptation stand out quite clearly, and are the more valuable that they are quite apart from modifications obviously in the line of evolution. They afford illustration of environment leading to adaptation, and heredity providing for continuity of adaptation in the life of the species. Of the two sides of the relation, constituted by environment on the one side, and by life on the other, the laws of organic growth are most important, leading forward to actual achievement in life-history. But, the demands of environment are necessary for calling into action, and for directing, those forces capable of producing modification of organism.[1]

A general view of the relations of life and environ-

[1] The record of these observations by Agassiz will be found in a series of three papers, published in the *Proceedings of the American Academy of Arts and Sciences*, the first in 1877, the last in 1882. The observations on the transference of the eye, are given in the second paper, published June 1878, in volume xiii. of the *Proceedings*. In the Laboratory of the Marine Biological Association of the United Kingdom, at Plymouth, my son, Mr. W. L. Calderwood, Director, has shown me examples of the different stages of transition in course of development of the fish. Mr. J. T. Cunningham, Naturalist to the Association, shows very interesting examples of deposit of pigment cells on the white side of the fish, consequent on its exposure to light.

ment; will guard against interpretation of facts exclusively by reference to struggle for existence, consequent on the relations of numbers to the food-supply. Granting Darwin's induction that 'a struggle for existence inevitably follows from the high rate at which all organic beings tend to increase,'[1] allowance must be made for wider modification of organism than this implies, as well as for limitation in reproduction as life advances in the scale. Life is too rich in variety to find adequate explanation of its history in the mere balancing of numbers with food-supplies. Life's potentiality, appearing in the laws of growth, of adaptation, and of heredity, presents attraction for the most exacting and most daring scientific investigation. In no life is progress to be explained exclusively by reference to amount of food-supply. Differentiation goes on more freely and more widely in form, than this would suggest. Darwin has said that the term 'struggle for existence' must be used in 'a large and metaphorical sense'; so must 'environment' be read much more largely than could be suggested by mere dependence on materials for nutriment.

When the distinction between animal life and rational is specially considered, the difference in relation to environment becomes more marked than at any prior stage. Dependence on environment continues for the highest life, as in the history of lower forms, but it differs greatly in degree and manifestation. In the case of the animals, we see them mastered by environment; in the case of man, we witness a mastery over environment impossible in the history of lower life. Of this mastery, evidence lies

[1] *Origin of Species*, p. 46.

all around. Cultivated fields, varieties of crop, the highways, the dwellings, and busy centres of industry, offer familiar testimony. In a large sense man originates his own environment. It is to his reproach, if he is mastered by circumstances. He is master, as no other living being on the earth can be. Perspective requires that the commonplaces of our life be contemplated at every point, as they appear in relation with the facts of animal history. Darwin's observations proved how largely power, in its aspect of muscular development, determines ascendency; we must here give prominence to power of a higher kind. Only thus does the order in Nature become visible. Everywhere, power in the life affects its own relations to environment. Continual change thus appears in application of fixed laws, consequent on higher potency in the life. Progress ever increases facilities for advance. Environment is at first Nature's gift; afterwards, it is what man has made it, by rational appreciation of Nature's laws. Civilisation reacts on the world itself. What is a railway in Central Africa, but nineteenth century civilisation carried into the midst of the country furthest in the rear; the results of thought, contrivance, and skill brought to the doors where their presence is least expected. Civilisation gives direct help to those least favoured in the race. Science and skill are bridging the chasm which severs barbarian from civilised. Abundance of the gifts of Nature, lying around the abodes of savage tribes, presents a large part of the attraction to this effort. Christian benevolence moves on the same tracks, but it comes from greater depths in the soul, and aims at higher results in the lives of suffering men. Engineer-

ing, engrossed in pioneer work, accomplishes a feat beyond its own calculations. Working immediately in the service of commerce, and simultaneously in the service of a large-hearted humanity, it leads the van of human progress. After the daring and the endurance of the explorer, come the best results of mechanical contrivance; after these, the rivalries of civilised nations; after these, all that is best in generous feeling and purpose. All progress is thus cosmopolitan; yet is it painfully manifest, all along the way, that there has been ceaseless struggle, untold suffering, manifold wrongs!

'Struggle for existence' has in this way a distinct meaning for each type of life. Each living creature must seek supply for its own wants, and failing, must suffer. Domestication of animals has tended to obscure, not a little, Nature's laws, which are more manifest as we look abroad on the earth, aided largely by naturalists who have spent their energies in discovering the rich varieties of life on the globe. Entomologists and butterflies are, however, widely apart, even when most closely associated. The love of adventure, characteristic of the naturalists of our day, testifies to the contrast between 'Nature' in its lower sense, and in its higher;—between 'natural selection,' and 'Nature's' higher work, when rational power is moving over the face of the earth. Rational life makes a new epoch in the history of environment. Progress has a new history in presence of a new agency. Rational life in itself, and by itself, discloses a potentiality previously inoperative. All 'Nature' becomes a larger thing, when 'Nature' includes humanity. For long ages, this greater amplitude of being has

subsisted; but even now, humanity has only broken through the surface of things, penetrating a little way into the secrets of Nature, to find by fresh gain, that secrets lie deeper still, threatening to baffle the efforts of men the acutest and most nobly consecrated.

CHAPTER V

HEREDITY AND EVOLUTION

THE persistence of species is matter of common observation. Hence the novelty of the thesis which Darwin announced, and the difficulty of giving credence to his theory, as if variation were quite as much a feature in Nature as persistence. When, however, Darwin stated his contention in these terms, 'that species are not immutable,' it became apparent that denial of the persistence of species was not involved. Darwin viewed organic life on a large scale, contemplating 'the affinities which connect together whole groups of organisms.' He said, 'I had never deliberately applied these views to a species taken singly';[1] and he made it his chief matter of congratulation that he had shaken the belief in the separate creation of species.

Laws of inheritance are conspicuous in the order of Nature. These laws are closely related with variation, as Spencer has shown.[2] In order that there may be true progress, acquisition must become a permanent possession. Without a law of inheritance, structural gain would have been restricted to the individual. Every life would have been doomed to struggle, as if nothing had been achieved by progenitors. Dependence on ancestors implies gain to offspring from

[1] *Descent of Man*, p. 2.

[2] Herbert Spencer's *Principles of Biology*, i. p. 256.

acquisitions of parental life. Individual life receives and transmits again. While, however, variations are possible, sudden changes in the structure of organism do not appear. 'Natural selection acts only by the accumulation of slight modifications, . . . each profitable to the individual under its conditions of life.'[1] The work of the naturalist has thus two sides, the one to trace 'the long and graduated succession' of modifications; the other to discover the laws of heredity in accordance with which slight modifications may be transmitted. Variation is one side, transmission only the other side of the same movement. Modified structure 'will impress some corresponding modification on the structures and polarities of its units.'[2] 'The units and the aggregates must act and react on each other.'[3]

A breadth of fresh light has been thrown over the difficult problem of heredity, by extended research into the minute variations that appear in the history of species, and of families belonging to the same species. By concentration on detailed illustrations it has become easier to trace the lines of reproduction. It has proved possible to mark the rise of slight variations and to trace their continuance in the life of progeny. That there are fixed laws of inheritance has thus become matter of certainty. It seems natural to suppose that favourable variations in structure would tell upon the reproductive elements. But a theory of heredity proves as difficult to make out as a theory of acquisition. Indeed, the difficulty as to heredity seems even greater, inasmuch as the action of

[1] *Origin of Species*, p. 211.
[2] Spencer's *Principles of Biology*, i. p. 256. [3] *Ibid.*

environment, as external and lying open to observation, greatly aids research, whereas the laws of heredity belong essentially to those processes of germinal growth which Nature has concealed. Nevertheless, it is certain that the same course of investigation which leads first to admission of variation, leads further to recognition of inheritance.

In view of the leading question before us,—Man's place in Nature,—as that must be concerned more particularly with rational power, it is well to mark that our study of heredity is directed, in the first instance at least, upon the laws of organic existence. There is a physical basis on which the laws of heredity operate. Organism presents at the outset the entire field of observation, whatever questions as to mental inheritance may afterwards arise. Structure and functions include the whole area of research, when now we turn to the phenomena of reproduction, as these may explain the origin of individual forms, bearing visible tokens of parentage.

The physical basis of inheritance is seen in the cell-life, in the germ-plasm, and the germ-cells, or, even lower still, in the 'physiological unit.' When differentiation of organic forms has been somewhat advanced, the physical basis is extended by the blending of male and female elements, after which the growth of the fertilised ovum passes through the several stages of embryonic life. What was hidden in the germ-cell is revealed at birth. The potentiality of the fertilised ovum is disclosed in the individuality of the newly-born life. This gives in outline the range of research, as we proceed to deal with the laws of organic reproduction. Questions as to intel-

lectual life are quite apart from the present stage of inquiry.

Considering how far these earlier investigations are removed from the problem of man's place in Nature, the conditions of our argument do not require more extended treatment of the subject here, than will suffice for dealing with the question of continuity in natural history, as that may bear on the most elaborate types of organic structure. We require only sufficient fulness of treatment to secure acquaintance with ascertained facts, and to guard adequately our later inferences, when dealing with the higher forms of life, as these give proof of the action of intelligence.

There is nothing more marvellous in Nature, as a manifestation of latent potentiality, than the germ-life out of which an elaborate organism is unfolded. The more extended the observation directed upon it, and the more careful the thought given to all the aspects of vital procedure involved in its development, the more must the mind be filled with astonishment. A very minute nucleus is the starting-point for the most elaborate organism! The fact is the same, whether the example taken be the organism of the dog, of the horse, of the ape, or of man. In the realm of material existence, 'vital organisation is Nature's masterpiece, summing up in itself all her other processes.'[1] Every physiologist grants that 'the fertilised egg is one of the greatest wonders within our knowledge.'[2] In the well-chosen words of A. R. Wallace,—'No thoughtful person can contemplate without amazement the

[1] *Process of Human Experience*, by W. Cyples, p. 497.
The Law of Heredity, by W. K. Brooks, Baltimore, p. 312.

phenomena presented by the development of animals. We see the most diverse forms,—a mollusc, a frog, and a mammal,—arising from apparently identical primitive cells, and progressing for a time by very similar initial changes, but thereafter each pursuing its highly complex and often circuitous course of development, with unerring certainty, by means of laws and forces of which we are totally ignorant.' This is the testimony from the newly-developed department of embryological science. 'The size of the particles which are derived from the parents, called the male and female pronuclei, the potentiality of which is so utterly out of proportion to their bulk, is almost inconceivably small when compared with the magnitude of the adult body.'[1] This minute fertilised ovum from which the elaborate organism springs, apparently a simple sphere with a pin-point centre as the nucleus of life, is yet complex in chemical and molecular character, and has within it provision for unfolding all the features of differentiated organism common to its species. What we see in the dog, the horse, or the ape, when maturity has been reached, is lying in germ within the ovum from which the life-development takes its rise. 'The ovum, in its young condition, is obviously nothing but a simple cell.'[2] Thus, 'it is in no way necessary that a germ should have the character of a miniature.'[3] The marvel is further extended, when it is added in the words of Professor Huxley, that 'it is

[1] Sir W. Turner's Address to British Association, 1889: *Nature*, vol. xl. p. 526.

[2] *Comparative Embryology*, by F. M. Balfour, vol. i. p. 19.

[3] Cyples's *Human Experience*, p. 490.

very long before the body of the young human being can be readily discriminated from that of the young puppy.'[1]

Taking next the mature organism which is the parent life, there is within this fully-developed body, a great variety of cells, only a limited number of which are reproductive cells. These last constitute a distinct order, each having its own individual life, dependent, however, for its continued vitality on its place in the parent life, and liable to modification according to changes in that life. These reproductive cells, containing the promise of the coming generation, depend for fertilisation on the union of male and female elements. These in vital combination start the new life-history. That the nucleus of the male cell (spermatozoon) penetrates to the nucleus of the female cell (ovum), has been ascertained. But observation has not supplied data warranting further inference, as to distinctive hereditary potency coming from each parent. With an organism so minute, and movements so difficult to watch, it is doubtful whether the data are likely to be found. But it seems clear from the facts of after life, that hereditary influence from both parents can be traced in the life of the offspring.

In thus briefly stating the characteristics common to the germ-cell of all species, including its structure and functions, the embryological testimony for continuity in organic evolution is seen to be striking. As the seeds of the several plants are distinct in Nature, so are the germ-cells of the several animals. From each fertilised ovum there is developed, by progression

[1] *Man's Place in Nature*, p. 67.

through a series of stages, a reproduction of the species from which it has come. 'Like produces like.' The continuity of species is demonstrated in every birth. However true it is that, in the early period of embryonic development, the fertilised ova of different species, pass through transformations startlingly analogous, the distinguishing features of the species to which each belongs, are uniformly presented when the embryonic development is complete. Whatever the argument for continuity, in respect of homologous embryonic structure and function, there lies alongside, equally clear and constant, evidence for the persistence of species. Organism continues its own history all through its procedure for reproduction.

In advance of this, we desire to see into the marvels of germinal life, if it be possible under microscopic observation to trace relative stages of progress, indicating how variation in the mature life may pass over as an inheritance.[1] Artificial fertilisation, in combination with ordinary phenomena of embryology, has helped. Nevertheless, conjecture and speculation enter considerably into the whole discussion, provocative of much scientific controversy.

The new problem is this, How do the laws of heredity provide, not only for continuity of species, but for transmission of acquired characters, 'profitable to the individual under its conditions of life'? While the law of heredity clearly implies that 'like produces like,' how does the likeness pass beyond the characteristics of the species, so as to include detailed likeness, and even a reproduction of the minuter features of organic form involved in family life? That these

[1] J. Arthur Thomson's *Theory of Heredity*, Trans. R.S.E., xvi. 91.

minuter phases of likeness are reproduced, is certain, even to the extent of reappearance of acquired characteristics; we seek therefore, if possible, to ascertain how such minuteness of detail is secured. Must we here be content to say with Darwin 'much remains obscure,' and will long remain obscure; or, may we hope to press inquiry further, with reasonable expectation of some addition to our certainties? The theory of Evolution of organic life is deeply concerned in this problem as to transmission of acquired characters. That strong testimony for Evolution is supplied by rapid improvement in the breed of animals under the care of the stock-farmer, is certain. The facts are so suggestive as to press onwards this course of observation. 'The problem for consideration is the mode in which these germ or reproductive cells become influenced, so that after being isolated from the cells which make the bulk of the body of the parent, they can transmit to the offspring the characters of the parent organism.'[1]

The conditions under which an answer to this problem can be sought are such as to involve the inquiry in great perplexity. The first thing essential here is to keep fully in view the facts already ascertained, having direct bearing on the problem. As to cell life, we are assured that reproduction is possible, in the first instance, apart from sexual differences, by growth of the cell, involving expansion, and multiplication, by severance of a young cell from the parent cell, thus starting a distinct individual life by division (*parthenogenesis*). Further, it seems clear that 'the germ-cells after their isolation take no part

[1] Sir W. Turner's Address: *Nature*, p. 527.

in the growth of the organism in which they arise, and their chief association with the other cells of the body is that certain of the latter are of service in their nutrition.'[1] These germ-cells are thus distinct centres of organic life, whose specific function is reproduction of the species. The laws of heredity are the laws of the activity of these germ-cells, as that may be affected by the vitality and functional activity of the mature body in which they have their sphere of existence. When biological advance is such as to involve difference of sex, there is the blending of two elements in the new life,—*amphimixis*,—from the two parents. 'The act of impregnation may be described as the fusion of the ovum and spermatozoon; the most important feature in this act appears to be the fusion of a male and female nucleus.'[2] Forthwith the combined elements work in unison, involving provision for double agency in the line of heredity. The after progress may be that of the larva, encompassed in food-yolk, or that of the embryo nourished in the womb. At the other extreme of observation, we are most familiar with the fact that in the history of families there is in family likeness the reappearance of the characteristics of both parents.

Here, then, are the known conditions presenting a problem of great perplexity. 'A single cell, out of the millions of diversely differentiated cells which compose the body, becomes specialised as a sexual cell; it is thrown off from the organism, and is capable of producing all the peculiarities of the parent body, in

[1] Sir W. Turner's Address: *Nature*, p. 527.

[2] *Comparative Embryology*, by F. M. Balfour, i. p. 69.

the new individual which springs from it, by cell division and the complex process of differentiation.'[1] Much is implied in tracing to such a germ-cell the beginning of a new individual, of whatever species. In case of dependence on double parentage, there is in the single life-movement a two-fold agency, conveying a double impress, providing for variation in the life of the offspring, impossible if reproduction were restricted to development by division of a single cell.

When the question arises, How is transmission of variations possible? the perplexities are the greatest which gather around any biological problem, for the germinal force is restricted to a nucleus, whose movements are visible only by the aid of microscopic power. In view of the minuteness of this cell, the fineness of nuclear fibres in which movement first appears, and the vastness of the organism thence developed, we cannot marvel when we find Weismann say,—'No one of the many attempts to solve the problem . . . can be regarded as even the beginning of a solution.'[2] And all this complexity of conditions, combinations, and movements, be it observed, is concerned exclusively with the origin of organic structure, before the large question of intelligence has even come into view. When this exclusively organic reference is considered, there is ground for reasonable surprise when we mark the readiness with which a histologist adds further complications of mental life and action. Thus Weismann says,—'In the higher organisms, the smallest structural details, and the most minute peculiarities of bodily and mental

[1] Weismann's *Heredity*, vol. i. p. 167. [2] *Ibid.*, vol. i. p. 167.

disposition are transmitted from one generation to another.'[1] This inclusion of 'mental disposition' shows the facility with which a vast inference may be accepted and stated. Even in face of the gigantic undertaking of explaining organic differentiation, it is assumed that the whole manifestations of activity, even intellectual and rational, are to be traced to the ovum in which physical life-movement has its rise. That 'the germ-cell produces all' that belongs to organic life, may be accepted as a maxim; but science is still a long distance away from any summary of evidence which can support a wider conclusion. It may not be unwise, therefore, to subdivide the vast subject, postponing the problem as to 'mental disposition,' as well as the still higher phenomena of rational life. We prefer here, at the outset, to deal exclusively with heredity in its earliest form, as beginning in organism, and concerned with the reproduction of structure and function, characteristic of a given species.

Taking the problem in this form, there are two available points of observation, that which looks towards the mature organism, thence attempting to think backwards to the germinal form; and that which contemplates the germ-cell, tracing thence from the earliest chemical and molecular movements, the elaborate course of differentiation. Darwin, as a biologist, trained in comparative observation of form, colour, and functions, naturally prefers the standpoint supplied by the mature life, leaning upon evidence of variation scattered over the annals of natural history. Weismann, as a histologist, skilled in microscopic research, naturally passes to the cell

[1] *Essays on Heredity*, vol. i. p. 167.

theory, giving unceasing attention to a field remote from that in which Darwin was a master. The choice of standpoint marks an obvious advantage for Weismann. He is a skilled explorer in the midst of the intricacies of the early stages of germ-action, and of development of life during the embryonic period. These two fields of observation must at length coalesce, if scientific results are to be reached. Each step in advance, from whichever side taken, must carry some promise of reconciliation, for it is impossible to doubt that all organic variations must be included, and that all of them are unfolded from the germ-cell within which individual life begins.

We are still, however, engaged in conjectures here, and must be content for the present to consider the balance of probabilities. Darwin adopted the hypothesis that the germ-cell receives contributions from all the cells of the body, and thus contains the germs of analogous parts for reproduction in the offspring. This is the hypothesis known as *Pangenesis*, derivation from the whole, in order to transmission of the whole. The cell is taken as a miniature of the body. This theory 'assumes that *gemmules* are thrown off from each different cell or unit throughout the body, which retain the characters of the cells from which they spring; that the gemmules aggregate themselves either to form, or to become included within, the reproductive cells; and that in this manner they, and the characters which they convey, are capable of being transmitted in a dormant state to successive generations, and to reproduce in them the likeness of their parents, grandparents, and still older ancestors.'[1] This hypothesis, though conjectural, faces the demand

[1] Sir W. Turner's Address, p. 3.

as to the mode of securing the result. Brooks has well said: 'A satisfactory theory of heredity must explain what it is in the structure and organisation of the ovum, which determines that each ovum should produce its proper organism.'[1]

On this hypothesis of *Pangenesis*, Darwin seeks to account for transmission of minute variations, along with those essential to the species. Tracing the laws of inheritance as these are suggested by comparative biology, he gives prominence to such points as the following:—'Two distinct elements are included under the term "inheritance,"—some appearing at birth, some "transmitted through the early years of life," which are developed only at maturity, or during old age.'[2] Thus the germ life discloses its potentiality in the line of growth after birth onwards to maturity. Even distinctions between successive periods of life are maintained in this way. 'A new character appearing in a young animal, whether it lasts through life or is only transient, will, in general, reappear in the offspring at the same age, and last for the same time.'[3] 'Most of our domestic races have been formed by the accumulation of many slight variations.'[4] 'All these cases are intelligible on the hypothesis of pangenesis; for they depend on the gemmules of certain parts, although present in both sexes, becoming, through the influence of domestication, either dormant or developed in either sex.'[5] From these illustrations it will appear how much any marked gain in structure and function must depend on inheritance of acquired

[1] *The Law of Heredity*, by W. K. Brooks, p. 40.
[2] *The Descent of Man*, p. 227.
[3] *Ibid.*, p. 228. [4] *Ibid.*, p. 230. [5] *Ibid.*, p. 231.

characters. The danger here, in respect of method, is that we are hypothetically inferring unknown organic procedure, so as to meet the demands of external observation.

Weismann enters into the hidden mechanism and its movements, with the view of deciphering the structural details, and the phases of activity within the germ-cells, which may carry an explanation of development both before and after birth. This leads to the heart of the question, allowing for Darwin's observations being held in reserve for a time. Weismann starts from the generally accepted positions in the cell theory, here to be carefully kept in view, that all life begins from germ-plasm, and assumes its primary individual form in a germ-cell; that for all life, germ-cells have a common structure, so that it is impossible to distinguish species by reference to the characteristics of these cells; and yet, that they have, in their distinctive constitution, the germinal provision for all that belongs to their species. As to the origin of these germ-cells, the ordinary hypothesis 'assumes that the organism produces germ-cells afresh, again and again, and that it produces them entirely from its own substance.'[1] Weismann denies this. Concentrating on the severance of these germ-cells from the other cells of the body, and upon the distinctiveness of their function as reproductive cells, he adopts the hypothesis of 'the continuity of the germ-plasm' as the causal energy giving rise to individual life in successive generations. Jäger, in discussing *Pangenesis*, had spoken of 'the reservation of germinal protoplasm.' The alternatives apparently open,

[1] *Essays upon Heredity*, vol. i. p. 174.

Weismann states thus:—'Either the substance of the parent germ-cell is capable of undergoing a series of changes, which, after the building up of a new individual, leads back again to identical germ-cells; or the germ-cells are not derived at all, as far as their essential and characteristic substance is concerned, from the body of the individual, but they are derived directly from the parent germ-cell.'[1] The latter alternative is the one he prefers. Weismann's hypothesis is 'that in each ontogeny, a part of the specific germ-plasm is not used up in the construction of the body of the offspring, but is reserved unchanged for the formation of the germ-cells of the following generation.'[2] According to this view, 'the nuclear substance is the sole bearer of hereditary tendencies';[3] these, on the hypothesis, are not drawn from the parent body. Acquired variations cannot be transmitted. A start is obtained only by union of the 'nuclear substance of the male and female parents,'[4] 'the fusion of two hereditary tendencies.'[5] On this hypothesis, the germ-plasm becomes the centre of vitality, having true continuity of existence—a kind of 'immortality,' he would say. Individual life has thus only its limited term, advancing to maturity, thereafter yielding to decay, and departing without even handing on acquired variations, 'profitable to the individual under its conditions of life.' Such, in outline, is Weismann's hypothesis. He does not claim that it is more than hypothesis, saying, 'it is possible that continuity of the germ-plasm does not exist in the manner in which I imagine that it takes place, for no one can at present

[1] *Essay upon Heredity*, vol. i. p. 170. [2] *Ibid.*, p. 170.
[3] *Ibid.*, p. 180. [4] *Ibid.*, p. 181. [5] *Ibid.*, vol. ii. p. 111.

decide whether all the ascertained facts agree with it, and can be explained by it.'[1]

Whatever may be the ultimate verdict on this bold hypothesis, the value of Weismann's work is such as must largely influence thought as to the perplexing problems involved. Little can be done here beyond stating difficulties which seem still to hang over the question, and showing some appreciation of the suggestiveness of what has been written. Darwin is strong in his array of natural history evidence for transmission of acquired variations. If that evidence be carefully considered, it will seem impossible to deny that acquisitions of one generation reappear in the next. There is an array of facts which clearly establish the conclusion. To the force of this testimony, theories of the life-history of germ-plasm must yield. On the same ground, the theory of Evolution by natural selection is sustained. Natural law provides for organic advance, and with this must be included heredity, securing continuity of useful acquisitions. When, however, we turn to Darwin's theory of pangenesis,[2] it seems impossible to extend to it the same acceptance. To suggest that the result is secured by all the cells of the parent body sending gemmules or germs representative of their distinctive character to be assimilated and absorbed in the individual germ-cell, is to present a hypothesis too cumbrous, too mechanical, too much out of line with the analogies of cell development, now well ascertained. That a cell, only a small fraction of an inch in diameter—and even the microscopic nucleus within that cell—should be the germ of the most elaborate organism, is

[1] *Essays upon Heredity*, vol. i. p. 176. [2] *Vide* p. 95.

so astonishing as to baffle conception. To suppose that inheritance of the characteristics of the species, and of variations acquired by immediate progenitors, is secured by planting a representative gemmule within the germ-cell, is to make too large a demand on imagination. There seems little doubt that Darwin's hypothesis as to *pangenesis* must be abandoned.

When next we turn to Weismann's hypothesis, there are many serious difficulties in the way of its acceptance. The chief of these come from the field of observation occupied by the naturalist. When Darwin's hypothesis is compared with that of Weismann, each is strong in the field with which its author is most familiar; each is weak on the side towards which his research has been least directed. But Weismann has this great advantage, that his chosen field of observation places him in relation with the problems of cell-life. His hypothesis is favoured in its start by the fact that the germ-cells are severed from the somatic cells, being set apart for the function of reproduction. While pangenesis suffers by diffusion of the work over the body, Weismann's theory gains by concentrating on these cells. Too much, however, seems to be made of 'isolation' of the germ-cells, which certainly are not severed from the vascular and nerve systems. Allowance, therefore, must be made for possible modifications in their structure in this way. The changes within the nucleus, the sending out of so-called 'polar' bodies, the splitting of the nuclear fibres, and all the other characteristics of cellular movements, favour the hypothesis that the germ-cell contains within itself, however dependent on the parent body, the

main secret of subsequent development. There seems much that is helpful in the suggestion which Weismann tells us operated on his mind in the course of his researches. He says: 'The facts of the transmission of hereditary tendencies from both parents to the child, together with the fact of parthenogenesis,[1] induced me at an early date to look for the essence of fertilisation, neither in the vitalisation of the egg, nor in the union of two opposed polar forces, but rather in the fusion of two hereditary tendencies.'[2] This last seems to state exactly what the facts require. At the same time, the aid here found towards explanation of procedure of germ-cells, is obtained at the cost of the hypothesis of isolation of germ-plasm from the action of the parent body. The fusion of two hereditary tendencies affords, under the laws of heredity, support for progressiveness in organic life; but 'transmission of hereditary tendencies from both parents to the child,' implies something more than transmission of the common characteristics of the species, and thus requires modification of the hypothesis. This demand is further strengthened by what is known of the dependence of offspring on parental vigour, and the evil consequences to progeny of diminished health in either parent, as well as by the mass of evidence affecting the lower animals, accumulated by Darwin, Wallace, and other naturalists.

Passing now from the sphere of microscopic research, we next take a more general view of the phenomena of heredity, as concerned with organic

[1] P. 91.

[2] *Essays on Heredity*, 2nd edition, vol. ii. p. 111.

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advance in the history of the earth. There are three main considerations supplying an explanation of the progress of life. These are the laws of organic growth, the laws of natural selection, and the laws of heredity. Under the first, we recognise the force everywhere operating for biological advance. Eimer[1] has done admirable service in concentrating on the laws of growth, when attention had become engrossed with natural selection. In course of his research, Eimer has brought into prominence, 'inheritance of acquired characters,' thus supporting Darwin against Weismann, who had reduced inheritance of acquired characters to a minimum. The first grand impression made upon us in observing the facts now ascertained is, that all animal growth, as presented in individual life, tends towards the perfecting of its own specific form, as it advances towards maturity. 'An organism is developed according to a plan which seems at every moment to be in advance of the stage actually reached.'[2] The life-movement has a fixed destination. Persistence of species is the assured result lying nearest the surface, and just beneath, appears the evidence that all individual growth, whatever the species to which it belongs, tends towards the perfect model of its own order of life. Thus when we have reached the third consideration named, it will appear that heredity is in its first intention a law of biological advance. Life of all orders is, in course of the individual development, unconsciously striving towards a clear gain in

[1] *Organic Evolution and Laws of Organic Growth*, by Dr. G. H. Theodore Eimer.

[2] *Human Experience*, Cyples, p. 495.

structure and function. Such is the coherence and solidarity of species, as illustrated in separation of germ-cells for reproduction, that the acquisitions by the individual prove gain for the species. If there be, beyond this, as most of us are now convinced there is, evidence for origin of species by natural selection, we are only finding that the first intention expands into enlarged intention, making provision for a general organic advance. Whether we are to interpret this movement according to a quicker rate of progress, such as Darwin has suggested, or according to a slower rate, such as Weismann propounds as the correct time-measurement, the general law of advance stands out as a leading feature in Nature. Nature's movement is one of evolution. And even if the slower time-measurement be thought the more accurate, there is striking testimony showing that deterioration has many checks placed upon it, while progression has not only many safeguards, but many active supports. The general law thus remains clear, however many the checks encountered in its application; hence the aid we find for interpretation of Nature's methods in the law of natural selection. Apparent hindrances are brought into line for service under the first supreme law of advance. The struggle for existence, with all its records of superabundant production of life, and of subsequent destruction of life, works for development of species as a whole. When at length heredity is included in its full significance, accepting Spencer's assumption 'that the units of which any organism is built up have an innate tendency to arrange themselves into the shape of that organism,' the young life is seen to receive and

preserve all the results of unconscious strivings of organism towards the perfect form of the species.

Hitherto we have been dealing with biology as it may be interpreted by reference to the laws of organism. We have included human life without reserve, no occasion appearing to draw any distinction, save that which is concerned with elaborate structural differentiation. Now we must introduce the outstanding feature of contrast appearing in rational life.

An entirely new question here emerges connected with interpretation of the laws of heredity. If we have touched the limits of organic development, we have not included the grand characteristic of human life. We have contemplated heritage as that can be stated in terms of structure and its functions; but we have still to deal with a larger inheritance, the possession of every member of our race. In this we find a new feature, giving to individuality a place not recognised at any lower stage of existence. Each member of the human race has a rational life, distinct from that which belongs to physical structure. This is the difference intended, when we say that reason is man's grandest inheritance. Granting all that has been said as to continuity of germ-plasm, there appears, beyond this, another continuity in conscious life. The organic does not pass into this, but is 'discontinuous' with that which is persistent on a higher plane. Reason belongs to the heritage of the individual, and is conspicuous above all other characteristics of human life. We seek, now, the new phases of heredity to be recognised when this grand distinction is included. The question is, can we trace heredity in the

history of conscious intelligence? The scientific investigations just sketched seem insufficient to reach this life. The whole scope of that research is seen to bear on organic action. If 'mental dispositions' are introduced, it is only in a casual way; the grand problem of a rational life has not been definitely placed in position. If we are referred to 'the protoplasm of judgment and of predication,' the protoplasm is unknown, the functions have never been observed. When, by process of fertilisation, a germ-cell is started on the movement to issue in the mature structure belonging to the species, this movement, as organic, does not provide for anything beyond somatic life. If more be claimed, it is necessary to demonstrate either that reflection belongs to the functions of organism; or that new conditions add to and transform the human germ. Neither Darwin nor Weismann faces the serious difficulty arising here. Either we must hold that the egg from which the human individual springs, exhausts the energy belonging to its nucleus, in somatic results, as in the history of lower organisms; or, we must hold that the human egg, or germ-cell, is somehow different in structure and functions from all other germ-cells, so as to provide for rational life. Biological science is placed in peculiar difficulty here. The whole tendency of scientific thought is adverse to the latter hypothesis. The success of the Evolution theory, as explaining origin of species, has given additional force to this tendency. The facts of our conscious life must supply the ultimate test, just as the facts of natural history, in the hands of Darwin and Wallace, have proved the test of hypotheses as to the hereditary principle in

germ life, when somatic results only were under consideration. The histologist cannot work independently of the psychologist, any more than of the naturalist. We cannot interpret the early stages of life, without reference to its advanced stages. In dealing with the question of origin, we must make account of what has been originated. In the attempt to do this in the case of man, a great additional perplexity is imposed upon biological science. What the microscopic nucleus provides for in respect of the physical life is so marvellously beyond possible representation on our part, that it is impossible, without serious perplexity for biological science, to state even in outline the vast additional work to be assigned to the nucleus, if it is held to contain provision for all the mental faculties. The complexity involved in the hypothesis of pangenesis,[1] great as that is, is simplicity itself, in comparison with the complexity we have here. Darwin at least concentrated on the germ-cell, and considered how it may contain the germ of the mature structure, thinking mainly of that. But after including all that belongs to bodily structure and function, we threaten to transcend all available powers of scientific investigation, when we propose to seek, besides, in a microscopic nucleus, the origin of all the powers of rational life. This hypothesis makes vast demands on faith, which must reckon heavily against its acceptance.

All questions as to evolution of intelligence in course of the natural history of life on the earth, must be reserved for a later stage in this inquiry. For the present, we deal exclusively with the laws of heredity,

[1] P. 95.

having application in the germ-cell out of which the individual human life arises. So long as we are concerned exclusively with somatic life, we regard man simply as a member of the animal kingdom. Our data are these: the structure of the germ-cell, the effects of its fertilisation, the union of two hereditary principles, and thereby the start of organic movement, which is the opening stage for the development of individual life. To this origin we trace the entire somatic results, giving all the characteristics of the organic life of the species, and, in addition, carrying evidence of distinctive heritage from both parents. The organic movement, begun in the germ-cell, completes itself in the mature embryo. Thereafter, the young life, under new conditions, develops the mature organism of the species. In comparative biology, this completes the movement. If we go further than this, we advance beyond the scientific basis afforded by embryology. When we propose, in the case of man, inclusion of mental powers, there is need for additional evidence, which must imply either additional structure, or some explanation beyond the structure of the germ-plasm. Research into the relations of structure and function, has driven from the field hypotheses such as Jäger's postulating a 'soul-stuff' coming from 'decomposition of albumen in various parts of the body.'[1] To keep the present line of inquiry perfectly clear, it is necessary to remark, as an interpretation of the scientific position reached, that it is not alleged that there is anything strikingly distinctive in the structure of the human ovum, or in its dependence on double hereditary principles, or in

[1] 'Zur Pangenesis,' by Professor Dr. C. Jäger. *Kosmos*, iv. 376, 1879.

the conditions of embryonic life. On the contrary, it is held to be beyond dispute that the analogies of animal life are maintained throughout the embryonic development of the child.

This being granted, the question of inheritance in the case of man, is raised into a conspicuous position. The evidence for inclusion of all that belongs to bodily life, seems to carry some testimony for *exclusion* of the wide range of mental powers. This testimony can be put concisely, and can be estimated with great advantage, by reference to recent advances in embryology. All the advantages of visibility are gained by turning to the plates in Balfour's *Comparative Embryology*, pp. 265-269; in Darwin's *Descent of Man*, p. 10; and in Romanes's *Darwin and After Darwin*, p. 153. The resemblance between the human embryo, and the embryos of animal species, is apt to appear closer than it is. But allowing to the utmost for this, how small can be held to be the severance, physically and physiologically! When we place over against this, the vastness of contrast presented by the rational powers of man, this closeness of resemblance belonging to embryonic development tells against the hypothesis that the nucleus of the human germ-cell provides for the rational life as well as for the physical. When the difference between man and animal has to be accounted for, it will be difficult to maintain the argument for reference of this difference to an embryo in structure so like to the embryo of animal species. That there remains great perplexity as to the inheritance of mental qualities, is a fact which does not lessen the force of the present contention. For what is now required is interpretation

of the appearance of rational power in man. All that is here urged is, that similarities do not explain differences; and the closer the similarity in the germ-cell and in embryonic structure, the worse the difficulty. After we have gathered our illustrations of the law that like produces like, there remains the question of the origin of species, and specially the appearance of man.

As before, in judging of the hypothesis concerning heredity, we had to pass forward to the evidence gathered by naturalists from the life of animals in their native resorts, so now we must pass over to the mature normal life of man, and specially to our knowledge of the facts of family history, including diversity of gifts. We agree that varieties appear in mental faculties, as well as in bodily structure; and we seek to know whether variations in mental faculty are transmitted by mere unfolding of the fertilised germ-cell. Comparative biologists, because of their sphere of research, become engrossed in the life-history of the germ-cell, and they naturally assume that the complete life of the species, mental as well as physical, is thus provided for. Nevertheless, Darwin, with other observers generally, recognises a two-fold aspect of human life. He affirms 'Man is variable in body and in mind.' He thus indicates that there are two distinct classes of facts, and, therefore, two problems, affecting human life. These two separate problems certainly do not emerge in our study of cell-life, and do not appear at all, in tracing the stages of development for organic life. What must be said as to animal intelligence will come up for separate consideration by-and-by. It is admitted, as to human

[1] *Descent*, p. 47.

life, that it presents two classes of facts. Can mental phenomena, with all their variations, be traced to the germ-cell?

Notwithstanding the large advance in our knowledge of embryonic life, a new and still more difficult problem arises,—where, when, and how do mental phenomena appear, in process of development of a human life?[1] This problem stands quite apart from the problem of evolution of life, which must be treated at a later stage, when we institute comparisons between animal and human intelligence. The problem now before us is one concerned with the development of each individual life. Attention is concentrated on the appearance of the higher phase of life which is common to our race. Here direct knowledge fails us. We are, therefore, restricted to such inductions as may seem warranted by familiar facts of our conscious life. As natural history has modified hypotheses concerning germ-plasm, so must consciousness of rational life modify the theory concerning heredity. Passing towards a field of conjecture, where we confessedly deal with the unknown, it is essential that we keep fast hold on the terms of our problem. Only thus shall we be warranted in venturing into conjecture, or in cherishing reasonable expectation of the reliability of our results.

Haeckel's treatment of the subject tends to obscure the problem. He would find the explanation of heredity in 'periodic wave-generation of the organic molecules,' making the reproductive power 'the equivalent of the memory.'[2] A mechanical hypothesis does not need memory, and memory at its best

[1] See Professor E. Ray Lankester's *Advancement of Science*, p. 52.
[2] *Gesammelte Populäre Vorträge*, ii. p. 70.

never reproduces anything beyond the imagination of what has been. Recollection of our youth does not reproduce it. To attribute to organic structure unconscious 'memory' of past achievement, and 'perception' of new conditions of existence, as preparatory for suitable variation in apparatus, is a hypothesis which attributes too much to the sensibilities of organism, too little to the characteristics of mental phenomena. In addition to the problem of organic existence, there is a mind-problem. It is raised by our own life. Its character is patent to observation, in the distinction between physical phenomena and mental, in the contrast between the life that depends on daily nutriment, and the life which gains by rational experience. The contrast belongs to natural history, just as the problem of 'animal intelligence' concerns higher orders of animal life, to the exclusion of lower forms. In the development of an individual human life, that which needs explanation is the appearance of a new order of activity, distinct from the movement of organic structure. All physical action is movement of apparatus; we localise it according to differentiation in structure; the development of separate organs, we attribute to the unfolding of the germ-cell. In the entire course of this development, and in all its results, we trace the application of laws of heredity. 'Like produces like,' through the fertilised germ-cell. In the history of this reproduction, however, we do not find explanation of the appearance of mental phenomena. Absence of this suggests that these do not arise in development of the germ-cell. We do not find as the result of its development,

manifestation of intelligence, simpler or more complex,[1] as we trace successive stages of organic advance. The distinction between life physical and life rational first appears to us in the life of the child after birth. In attributing intelligence to the child, we recognise that development by nutrition does not include development of mind. As food and education are reckoned apart, and provided for under different charges, so, when manhood is reached, athletic exercise does not develop mind, though we admire good physique the more when associated with a highly-trained intellect.

When, on these grounds, it is maintained that mental phenomena cannot be traced to germ-plasm, a new problem is raised as to the appearance of mind in the history of the individual life. Beyond this arises the question whether laws of heredity apply here, as in the physical life. These are problems of great perplexity, first for biological science, as they elude the research of comparative embryology, and next for mental science, as they carry inquiry beyond consciousness, and also beyond outward observation. The presence of mind is certain; the mode of its appearance in the individual history is unknown. The fact is sure, its occurrence must be left to stand as a thing undiscovered. The field of our observation is thus restricted to the relations of the intellectual life to parentage, while we seek evidence for heredity in mind, as in body. All reasoning here must be from the facts of human experience, towards probabilities connected with the origin of intelligent life, and with its subjection to laws of heredity. In default of direct

[1] What the facts are will be considered in next chapter.

evidence, we are left to draw inferences from the mental characteristics of men, recognising first that which is common to the species, afterwards variations giving distinctiveness to individual life.

In attempting to reach conclusions attainable in this way, we see at once that in human life there is something distinctive in the relations of parent and child. The common vital relation is implied in the virtual life-unity of parent and child. Life-unity must, however, have a larger meaning here, unless we are to maintain that the higher rational life of the parent is out of relation with the embryonic life within. The supposition seems inadmissable. The relation of the living germ to the parent body may, however, reasonably supply some analogy, in accordance with which we may, not unwarrantably, think of the relation of the child-soul to the parent-soul. The value of such an analogy is however difficult to determine. The beginnings of mental life may be held to belong to the life of the embryo. This conclusion is not affected by the fact that the dawn of consciousness—the first intelligent discrimination of the self from the not-self—which is the first independent action of a rational life, belongs to a period considerably after birth. True as it is, that knowledge, as a conscious possession, begins with independent experience on the part of the knower, this does not render it less probable that the beginnings of intelligent life are responsive to the experience and action of the mature intelligence of the parent. It seems improbable—may we not say impossible—that a mother can give birth to a child without the heritage of the young life including not

a little that has been dependent on her mental life. If in reference to organic life, we say, what the parents are, that the offspring shall be in the order of animal species, it would seem that by analogy, we may say, what the parents are as intelligent beings, that their child shall be in like manner. This seems a legitimate reading of continuity in Nature, and if it be, then it seems to follow that the mother's experience within the period of vital unity assigned to parent and offspring, must be to some extent an influence, a very variable influence certainly, in the history of the young life. To suppose that the mind-life of the mother is completely severed from the child-life nourished in the womb, were contrary to all the lessons of analogy. Confirmatory evidence is abundant, including the wide range of pathological illustration.[1] On account of the higher characteristics of the parent life, 'inheritance' in human life must have some special phases. If, in the natural history of physical life, the germ-cell is separated and localised so as to provide for reproductive action: if germ-plasm may have a certain continuity, in whatever way, through a series of generations; and if fixedness of species is thus perpetuated; mind-life apparently must have a distinct origin. Hence 'heritage' here must have in some respects a wider significance. All this seems reasonably to follow, even while it remains impossible to reach definite conclusions as to the origin of mind. Further, when the relations of parent and child are considered, evidence of heredity in mind appears to imply much more direct action of mind

[1] The case of Alan M'Aulay, in Sir Walter Scott's *Legend of Montrose*, may illustrate extreme cases of this kind.

upon mind, than occurs in action of the mature organism on the unfolding germ-cell. In its beginnings, it seems as if the life of the germ-cell were in some ways more independent of the parent life, than the mind-life of the child can be.

Seeking, in harmony with these conclusions, such evidence as may be available in support of heredity in mental history, the utmost that can be done here seems to be classification of mental phenomena, such as may guide to inference. There is a large mass of facts to be so classified. Deeper consideration of these seems required in order to come to some fuller interpretation of man's place in Nature.

Of these facts, the main body belongs to the borderland, where relations physical and mental come together under notice. These appear in a variety of aspects, but the relations of the two sides of our nature are certain. Heed must be given, however, to the two modes of knowing, as well as to the dualism appearing in the single life. We may, therefore, have to contemplate facts, first from the physical side, afterwards from the mental side.

All our relations to external Nature supply points at which variations in physical life, hereditarily transmitted, have a bearing on mind-life. Variations in general susceptibility of the nerve system, and in structure of the organs of special sense, involve specialities affecting the whole individual life. Here we include also the facts belonging to the tangled history of hereditary disease, and special variations in nerve and brain, depressing or exciting. These differences lie strictly within the lines of physical inheritance, yet they deeply affect personal experience, and must have

a bearing on conditions of individual responsibility. In not a few cases they involve demands upon intellectual and moral control, of an unusually exacting kind.

If next, we take action and experience originating in individual mind itself, evidence as to transmission becomes involved in more complexity, and is therefore more difficult to trace. Here we begin with rational power as a common possession, taking with this, all emotion, sentiment, and aspiration depending on it. We attribute rational powers to all the race; at the same time, variations, many and considerable, appear. The analogy of adaptation to environment passes to a secondary place, and even in some phases disappears largely from view. Under sense of a new demand upon language, we speak of 'mental' culture, recognising what 'education' means, with its special appeal to understanding and intelligent effort. As interpreted in our own experience, we are conscious of reflection, purpose, and sustained effort, all of which are reckoned among powers common to men. When inductions become wider, consequences in family and in national history being included, laws of heredity seem to find enlarged application. Human progress is not severed from personal effort; and such effort does not fail of securing gain more widely than personal life. Always acting through physical life, as we are bound to say, effects are such as must influence the history of later generations. Even if it be granted that there is warrant for the opinion recently expressed, that no great advance is to be expected in adaptation of human organism to its environment, there is constant testimony to physical and mental advance of the race. We witness fineness

in physique clearly depending on continuous culture of mind, and reacting on mind-life in wonderful ways. But, each individual must gather his own experience, must accumulate his own knowledge, must form his own character. No one can hand on such acquisitions. Nevertheless, the inheritance of each child, and family group, is largely affected by what the parents have been. We must deduct results of education, always great, whether for weal or for woe; but after this has been done, heritage counts for much. Speaking with utmost reserve, this must be attributed to the closeness of life-relation between mother and child, as the life of the child represents the union of two hereditary principles.

When, however, advance is attempted beyond this, we are largely restrained. Evidence becomes greatly restricted. Exceptions are too numerous to sustain a general rule. Granting the value of the evidence which Galton has adduced, it is significant that he should regret the title, *Hereditary Genius*, explaining that he refers only to natural ability, 'such as a modern European possesses.'[1] In human history, there are two broad lines of fact, which go far to restrain general inference as to heredity in intellectual gift. Genius starts up in many places where hereditary preparation for its appearance is far from manifest. So frequently is this the case, as to suggest that some other law is operating in the history of our race than our records help us to trace. Again, in the family history of the highly gifted, it often happens that children do not illustrate continuity of gift. Facts, sufficiently numerous and noticeable, hamper

[1] *Hereditary Genius*, 1892, Prefatory Chapter, p. viii., p. x.

efforts towards induction. Physical inheritance often so burdens life, as to obscure the range of intellectual gift in possession; and from a multitude of causes besides, there is a vast amount of undeveloped talent. In view of the incompleteness of evidence here, definite inferences as to heredity in mind seem impossible. It is certain that useful variation in organism is transmitted; transmissions of variation in mental power seem less obvious. There is an independence in mind history impossible to bodily life.

Some wider induction seems to await us here, on account of the unity in which the dualism we are remarking is involved. Mind is not spiritualised body; nor is the human body itself spiritualised matter; but there is a wonderful unity here, still beyond reach of science. The soul life is so encompassed by physical conditions,—is in the history of the unfolding of its powers so connected with physical aptitudes—is so dependent on physical sensibility and muscular activity, for stimulus and outlet,—that possibilities of mental development must be much more closely connected with the physical nature than we are as yet able to ascertain. If organic life has, by slowly accumulated acquisitions, proved equal to the task of securing greater adaptations to environment, there must be some large meaning here in the history of mind as it has advanced towards extended consciousness of freedom and power.

If, then, the origin of mind in the history of the individual belongs to the unknown, how shall we think of individual development, so as to keep within the limits of our knowledge? With man, germinal life begins as does the life of the animal; embryonic

life unfolds by successive stages of advance similar to those of embryonic life in animal history; the ultimate configuration of the body is secured after the manner which provides for the mature embryo of other species. But, notwithstanding this closeness of resemblance, human life from the first movement of the germ-cell to the moment of birth, is conjoined in life-history with a mature rational life. As, in personal history, mental life constantly tells on the physical, so must it tell on the embryonic life depending upon the parent life. Each life thus owes its start in the history of its intelligence, as well as of its organic existence, to the parent life. Parentage must imply special responsibilities, connected at once with physique, intellect, and character.

These investigations lead to distinct conclusions, depending on the difference between body and mind. All the more familiar laws of heredity are concerned with the relations of the germ-cell to the fully-developed organism. These laws provide, more obviously, for transmission of the characteristics of species, and next for transmission of variations in structure. Such laws are applicable to man as to the lower animals.

But 'man is variable in body and in mind.' Human life presents a two-fold problem. Have then body and mind unitedly and equally their origin in the nucleus of a germ-cell? Can it be maintained that the whole range of mental powers, as well as the physical powers, spring from the minute point of organised matter? The close analogy between human life and animal life, first in the structure of the germ-cell, and afterwards in all the stages of embryonic

development, points to an opposite conclusion. Some higher origin we must seek, for a potentiality so much higher than appears in organism. Observation of the functions of human life has carried us beyond differentiation in structure, and beyond division of labour in physiological functions. Evidence for distinctiveness of rational life lies clearly before us. Advances in moral character, the most important of all variations possible in human life, cannot be transmitted to the succeeding generation. Each individual must achieve his own victories; none can hand down such gains. This marks the presence in Nature of a new order of life, whose functions transcend those of the cells and tissues and organs of a highly specialised animal. Here, individuality, as personality, is subject to a new order of laws. In accordance with these, a type of excellence is presented in which the most highly organised animals have no share. To power of insight, special to man, an orderly system of existence, unseen by any life lower in rank, becomes visible in Nature. By use of understanding, of wisdom, and of rational purpose, the individual forms for himself a moral character, in which no other life can share. Limitations of heredity become conspicuous here. The rational agent may either gain by heredity; or he may suffer under the laws of inheritance. As most differ in their lot, some having, under head of patrimony, large inheritance in property, others but few possessions; so have they differences in life-inheritance. Such differences are in every sense more serious, as affecting development and experience. Possessions are external, heredity is vital. The gravest questions of responsibility arise here,

first on the parental side, next on the side of the individual agent, who must accept his vital heritage, whatever its special features. But the limits to heredity, secure for every man wide scope for sustaining some better hope. In normal human life, heredity settles only subordinate conditions, leaving open large scope for rational and moral endeavour. Set inheritance at the extreme of disadvantage; it cannot hinder exercise of reflection, regulation of sentiment, government of disposition, and formation of moral character. As loss of sight, or of hearing, or of powers of locomotion, may restrict the possibilities of effort, so may a lack, which heredity determines, lower and shorten the range of potentiality belonging to the life; but where the common heritage is secure, intellect and will, the light of duty can shine, fulfilment of duty can gather rewards, and the highest excellence of human life is fully within reach. Again, set inheritance at the extreme of advantage, including physical vigour and gifts of genius; these are insufficient to secure the excellence of life. Not without personal use of wisdom, and self-control, and exercise of self-denial, larger probably than is required in most cases, can the highly favoured in respect of life-heritage reach to excellence of human life. A man may inherit large property, and also inherit power to squander it; he cannot inherit true greatness. Whether he is to be mean or to be noble, he must himself decide. A man may be heir to a great name, but, if he is to escape having it hang as a reproach around his neck, he must by his own endeavour, rise to the level on which his progenitors previously moved, to their own lasting honour.

CHAPTER VI

SENSORY AND RATIONAL DISCRIMINATION

COMPARATIVE biology places in contrast the sensory discrimination possible to all life, and the rational discrimination characteristic of man. We have now to seek some closer acquaintance with this difference, preparing for an instructed judgment upon the theories concerning the history of life on the earth. The test is reached here. Thus Darwin reasoned concerning the data on which a theory of Evolution must depend: 'If no organic being excepting man had possessed any mental power, or if his powers had been of a wholly different nature from those of the lower animals, then we should never have been able to convince ourselves that our high faculties had been gradually developed. But it can be shown that there is no fundamental difference of this kind.'[1]

Thoroughness of treatment requires that we keep in the first instance to broadly marked differences, so that we may afterwards advance more surely upon resemblances. The question of 'mental power,' or 'mind' here attributed to animals,—that is, to some animals,—Darwin names 'the higher mammals,'—must therefore be held in reserve for separate consideration. We start with a broad distinction, universally recognised. It is the difference between

[1] *The Descent of Man*, ch. iii. p. 65.

sensibility,—the sensitiveness belonging to every organism, even the lowest,—and the rational power of man, attaining to generalisation from particulars. The former belongs to the star-fish and snail; the latter belongs to man only. In the first case, we include the lowest life; in the second, we exclude all but the highest. In the mollusc,[1] organism, function, and experience are at the lowest; in man, all these are at the highest. Equally sharp is the contrast when activity is contemplated. In the mollusc, activity is correlated with sensibility, its end being the securing of nutriment from the current of water passing through the body. In man, activity is also correlated with sensibility, though on a grander scale; but there is this difference, that in man activity is largely concerned with attainment of knowledge and of right conduct. Our ultimate question is, has the highest been evolved out of the lowest, through 'numberless gradations.' Our primary problem, here, concerns the difference between sensory discrimination and rational. Contrast is at this point the first requisite for precision. Boldness of outline will abate the difficulties of an inquiry so vast as that presented by comparative biology. If biologists propose to attribute 'mental power' to the mollusc, the discussion as to 'mind' begins from the first appearance of life. If biologists propose to attribute mental power only to 'the higher mammals,' there remains a preliminary and more general question, as to the discrimination which is possible to all organism. In any case, 'ideation' must be carried to the rear, while

[1] Carpenter's *Mental Physiology*, p. 45; Calderwood's *Relations of Mind and Brain*, p. 123.

we contemplate organic sensibility. This is more widely distributed, and it came earliest. If any one take sensibility as equivalent to 'mind,' the form of the problem is changed; the difficulties as to the appearance of rational power continue as before.

If we are to escape play upon words, we must come to sharp distinctions between sensibility and rationality. Familiar facts show a marked severance between the lower forms of life and the higher mammals, and a still wider distinction between simpler organisms and the human species. If only we make sure that we start our inquiry with a function common to all life, there will follow obvious advantages if we contrast that with such 'mental characteristics' as are common to men. In following this course, full account must be made of the continuity of structure and function already recognised. A man is sensitive to contact as a mollusc is, and just as a monkey is. Nerve fibre, nerve cell, and brain, are severally homologous in structure and functions. Thus far, we deny nothing to the lowest organism which we claim for man. Sensitiveness in the organism, succession of sensory impressions in the history of the life, and correlation of these with activity through the nerve centres, are characteristics of all organic life, including that of the insect with that of the man.

What, then, is it which is peculiar to man? It is his rational discrimination, in advance of sensory discrimination. All organism feels contact and acts in response to it. All human life not only does these two things, but also interprets experience, thereby forming a knowledge of the things with

which the sensitive organism comes into contact. This contrast is bold and sharp in outline. We first say, it is with the man as with the animal; we next say, it is not with the animal as it is with the man. What is the difference between sensibility, common to man and the star-fish, and rational discrimination belonging only to man? It appears first in the contrast between successive sensory impressions and consciousness of difference between past and present impressions. This contrast visibly widens when rational power carries its exercise further, accumulating knowledge by generalisation, giving fixedness to knowledge by use of names, and attaining to wider inductions, recognising general laws of Nature. Sensibility as a life-experience is precisely the same through the whole scale of life from the mollusc to man. Whether the elements in which life subsists be water or air, sensibility is stirred by movement of this element. So it is with the functions of special senses. Certain movements in the atmosphere distribute light, others distribute sound; sensibility is the same in kind for animal life in contact with these atmospheric movements. Whatever differences there may be in terminal arrangements for the special senses, all life possessed of such special sense depends for sensibility on an optic or auditory nerve similar in structure. The strength of evidence for continuity in structure and function up the scale of organism, largely increases the difficulty of reaching a scientific explanation of rationality by reference to structure.

What, then, is observation, as distinct from sensibility? It is interpretation of sensory experience, when using the senses for rational ends. It stands

in contrast with sensibility. In observation we pass from experience to objects. Observation is impossible without consciousness of the distinction between self and successive experiences: and also of the distinction between experience and external objects. Endless impressions are being made on the senses. Many of these are not observed by us. The organs of sense act exactly as when observations are made; but no account is taken of the presence and significance of these impressions. Men may gaze together on the same scene, yet in no two cases are the observations the same. It is this difference which creates the interest of conversation concerning places visited. What we need is an exact account of this power of observation, on which all science depends, and by-and-by a scientific account of its appearance in Nature. The first problem is here preparatory for the second.

Without organs of special sense, observations by sight and sound were impossible; but, even with these organs, observation involves exercise of a higher power. Hence our double use of terms in describing what seems to us a single exercise. There are obviously two distinct exercises, the one that of the senses, unconsciously executed, the other that of the rational power, consciously done. Nevertheless, we take 'vision' as if it were equivalent to 'observation,' simply because the latter is familiar to us in remarking what is around. 'Vision' belongs to all animals possessing eyes, though 'observation,' in our sense, supplying conditions of observational science, is impossible to animals. We properly attribute 'sight' to the eyes, and an animal sees just as we do; but there is besides a power in use with us, distinct from the organ of

vision. We see much that we do not observe, and we observe what an animal does not see. Thus it is matter of frequent remark that we did not notice objects which we had seen, and which we would have noted if our eyes had been directed upon them by ourselves for observational ends. On the other hand, when we observe that all the stones in a bank, being opened for a roadway, have been rounded by the action of water, we remark what no animal sees. Thus the structure and function of special sense are separate from rational power, exercised in observation. We here identify a power not included among the functions of the sensory system.

In all observation, there is *interpretation* of the various effects of sensory impression. We invariably compare these with the facts of a past experience. No explanation of this is found in recurrence or remembrance of sensations. Without memory, we could not make and record observations; but observation is distinct, and puts memory to use,—brings it into exercise, in order that an observation may be completed. We make observations only by using associations of similarity and dissimilarity in judging of objects. We deal with experiences, like and unlike, past and present, always recognising outward differences by reference to inward. Without this, there could be nothing but continuous feeling, or feeling merely rising and falling. By comparison of impressions, we gain our knowledge of *things*.

In prosecuting observation there is a further advance. We are always representing to ourselves the class to which an object belongs. The object observed is not merely a thing. It is not merely

large or small, moving or at rest, but it is one of a class grouped under a common name, selected to aid us in this work. We keep adding to the value of classifications as we continue observations. Sensations are thus seen to be only the first tenants of consciousness. In noting their presence, intelligence wakens up to activity. Sensations are thus lower than observations, observations being our interpretations of sensation. This rational activity belongs even to the childhood of our rational life. There is a native power in man which uses the special senses as a mechanic uses his tools. If we cannot with strict accuracy speak of 'inherited knowledge,'—though Herbert Spencer thinks we may,—certainly rational faculty must be described as inheritance,—so much given to us as the condition of knowledge, just as the merchant must have his 'stock-in-trade' for bargain-making. In the act of observing, we use laws of thought, specially applying a law of causality so as to interpret successive experiences. Without these, observation would be impossible; education could make no progress; science could not have a beginning.

Let us attend for a moment to the *internal observation* involved in marking the differences in our own feelings. Though we name this 'introspection,' and often speak of it as if it were a difficult exercise, it is common to mankind from earliest years. How a man felt in given circumstances is a common subject of remark. Thus we single out differences in our consciousness. On some of these we have relied, in affirming differences in objects. We mark successive phases of experience, much wider and more varied than these, such as our emotions, which have no

equivalent in material existence. Qualities of objects are very different from changes of feeling within us. Sensory apparatus supplies a connecting bridge between outer qualities and inner experiences; but the efficiency of observational exercise, resulting ultimately in knowledge of objects, is neither in the objects, nor in the organic apparatus placing consciousness in relation with them, but in the power of the rational life itself.

Mere sensory experience, in us as it is in animals, must be assigned a separate place, as physiological, to be grouped under a distinct classification. Observation, resulting in knowledge of objects, and also in knowledge of ourselves, stands on the other side. The efficiency of sensitive structure has been exhausted, before we distinguish sensations as differing from each other. Discrimination of feelings thus proves to be a first step towards distinguishing of things. This is the familiar fact, constantly presenting evidence of a function of life beyond organic functions. Without further aid from organs of vision, and altogether by reflective exercise, we perceive the rich variety of experience belonging to a rational life. We do not any longer contemplate observations of external objects only, but ideas and associations, thoughts and fancies, hopes and fears. Within this rich amplitude of experience, we exercise power of self-criticism, in use of which we estimate variously the worth of our thoughts and reasonings, and judge of the warrant for our expectations and apprehensions. The subject of criticism is our own intellectual action, for which we acknowledge individual responsibility. In this, we affirm a causality which we do not attribute to sensory

apparatus, and which cannot be scientifically explained by functions belonging to terminal organs, nerve fibres, and brain.

Recognition of rational causality, involving individual responsibility for one's own thought, becomes a turning-point in this discussion. The facts to be explained in human life are now seen in their natural proportions, invisible at any nearer point of our approach. In order to give a scientific view of man's place in Nature, we must account for this rational causality, tracing the history of its origin on the earth. The causality of organic life, and the causality of rational life, are now seen in contrast. The outcome of the one is mechanical movement, responding to sensory impression; the outcome of the other is thought, first appearing in observation. For organic life, the condition of improvement is nutriment; for rational life the condition is self-criticism. In the realm of natural history there are thus two distinct orders of life at work; and these are combined in human life; they are not continuous: the sensory process is 'discontinuous.' These two cannot be compared, as if the higher were only an advanced stage of animal life. Rational life cannot be judged by muscular development, as judges decide in a cattle-show. All that has been ascertained regarding 'rudiments of organs,' 'homologies' in structure, and 'continuity' of organic life, retains its value as a contribution to natural history; but it has no scientific worth for explanation of rational causality. Whatever may afterwards be said about the higher mammals, it is impossible to maintain continuity of life from the lower forms of organism up to the rational or reflec-

tive exercise, concerned with observational science, and with strivings towards an ethical ideal.

These outlines of research show how essential for advance of a true science of Nature is a classification of the sciences. Whatever the value of our modern watchword 'continuity,' the need for division of labour remains with us, as also the need for classification of functions. Physiology and psychology are concerned with distinct phases of existence. Beyond doubt, man belongs to Nature; but it is impossible to explain his activity within the area of the natural sciences. A doctrine of the soul must be distinct from a doctrine of organic function.

It follows that final results cannot be reached through research into what has been named the 'mechanism of thought,' or the physics of thought and movement. Research of this kind is needful for a true knowledge of our life. In this department of inquiry, our obligations to Ferrier, and Wundt, and Münsterberg are very great. But for full interpretation of the causality of human life, as presented in the ordinary consciousness of the race, we require a department of science, which shall constitute a true Psychology, distinct from Physiology. Appreciation of the facts brought to light by experimental psychology demands this. The facts of consciousness disclose a vast region of inquiry, lying quite beyond the sphere of experimental psychology.

All that is carried into the physiological laboratory belongs to the physics of thought and action. Investigation is concerned with the mechanism of sensibility and motion, with apparatus whose efficiency has its explanation in chemical, or molecular, or

mechanical forces. We are not to be misled by the title 'Experimental Psychology.' That the phenomena of nerve action bring observational science into relation with the action of a rational nature is clear; but this relation implies difference. While all the phenomena of nerve action are included under experimental psychology, all the phenomena of consciousness are excluded from this field of observation. This separation is proclaimed in the mode of inquiry essential to experimental psychology. Experiments by electric excitation of the sensori-motor system confirm this; as do all experiments depending on use of mechanical contrivances. The region of inquiry is restricted to organism; the mode of inquiry is restricted to external observation. So long as we deal with molecular movements, it is clear that speed or rate of movement is calculable, if only an instrument be constructed sufficiently sensitive to record results. When we turn attention to contraction and expansion of muscles, observation becomes more simple, because the structure is visible to all, as it is more massive. In these relations, a wide and deeply interesting field of observation has been opened up. The larger portion of it is concerned with organism; but it bears witness, so far as external bodily movements can do so, to phenomena of consciousness, connected with the phenomena of organic life, but unexplained by them. The limits of electric excitation strictly define the line of severance. Here, as elsewhere, observational science lays down its own boundaries.

Within the territory of physiology lie all the phenomena of reflex action. These belong to organic life of every grade. Beyond these, in human life, there

are additional phenomena of organic action, allied with the facts of consciousness. This set includes a section of the field of 'experimental psychology,' and warrants the title. Only in connection with human organism can physical relations to phenomena of consciousness be studied. And there is this further and quite unique condition of inquiry, that observation dealing with the relations of consciousness to organism is restricted to the experience of the individual observer. The limits of electric excitation of organism mark sharply the line beyond which every experimenter must depend upon his own experience. Phenomena of consciousness cannot be included within the science of organic life.

Let us remark the precise measure of value belonging to experimental psychology, judged by its best work. The area of its simplest work is restricted to organism, dealing wholly with reflex action, depending on the one side on sensory apparatus; on the other side, on motor apparatus. When a sensory nerve has been stimulated, a motor nerve acts in consequence. The later stimulation is the response to the earlier. Here measurements of time and of force are possible by aid of suitable instruments. As by observation of the interval between sight of the flash of light when a cannon has been fired, and the hearing of the atmospheric effect, we can measure the rate at which sound travels, so with reflex action in organism. If we would measure the effects of the prick of a needle, we must mark the relation of contact with the muscular response. The chronograph can render visible aid here. Still more readily can the myograph aid us in measurement of the contraction and ex-

pansion of a muscle. But all this observation would be unmeaning,—would be even impossible,—if there were not in the observer rational discrimination dealing with cause and effect, so as to interpret occurrences. Organism does not provide for such observations.

Beyond this, in the field of experimental psychology, lies the inquiry concerned with the relation of organic functions to the facts of consciousness. Here, as we have seen, the observer is restricted to individual experience for the main part of his observations. The questions raised are of a different kind, for they concern the relation of organism to a higher form of life. On the one side, are variations of sensory experience; on the other, discrimination of surface, form, and colour in objects. Quite beyond this, entirely out of reach here, is our treatment of the problems of existence, speculative in their character. Between the physical and the speculative, there lies a wide region for investigation, within which may await us many discoveries of deep interest. To this area belong such questions as these:—how the higher emotions and loftier sentiments are related to bodily functions, affecting rate of circulation of the blood,—how the rush of sympathetic feeling connects with physiological action,—how patriotic feeling by its utterance makes the cheeks glow, — how abstract thought places restraint on muscular activity, yet taxes the brain. Throughout, a higher phase of action is prior to the organic, and even accounts for the latter. So distinct are the phenomena of consciousness, from those movements measurable by mechanical contrivance, that the former do not come within the

field of measurement. Hence it is that the instruments valued in experimental psychology render no aid in interpreting the phenomena of consciousness.

The facts of external observation are set on one side, the facts of rational exercise are set on the other. This much is implied in the correlated claims of science, and of philosophy. As the argument for continuity of life is strong along the whole line of research concerned with organism; so is the argument for breach of continuity strong by failure of physiological science to include the phenomena of rational life. Experimental psychology has become demonstrator of the contrast. Thus, fresh force is given to the words of Professor Burdon Sanderson, already quoted:—'There is little ground for the apprehension which exists in the minds of some, that the habit of scrutinising the mechanism of life tends to make men regard what can be so learned as the only kind of knowledge. What we have to guard against is the mixing of two methods.' The law of induction is the same, but it is applied in two spheres. The laws of observation are identical, whether observation is directed upon the external or upon the internal. But there are two modes of observation, the one by eye and hand, and auxiliary senses; the other by direct consciousness belonging to a rational life. Inclusion of the facts of rational activity with functions of organism cannot be maintained. Rational discrimination stands distinct from sensory discrimination.

Acting according to its own laws, and exercising gift of self-criticism, rational power concerns itself with the manifold forms of existence. It distinguishes at once the elements of conscious ex-

perience, and the qualities of external objects. It seeks for general truth in the midst of innumerable particulars. It penetrates into the secrets of Nature, refusing to be checked by any limits, save the conditions of its own activity. It forms its ideal of human life; it carries forward civilisation in the life of a nation; it grapples with the scheme of existence as a whole, making the Universe itself its field of study. This rational power presents the problem for humanity, a problem ever widening and enlarging, as men seek to know more of the cosmos.

Simply by his possession of rational power, every member of the race goes forth on his way as a freeman, taking possession of his inheritance in the earth. For every man who does not lose his way in darkness, or through blinding passion—overwhelmed by life's mysteries, or besotted by animal indulgences—a rich possession is waiting, quite above supply of the common requirements of organic life. Science is his servant; literature is his property; philosophy is his guide in higher thought; revelation becomes his inspiration. Under warrant of abundant evidence, we distinguish two worlds in Nature—the world of matter and the world of mind; a world visible to the eye; a world invisible to organism—visible only to rational insight.

Rational discrimination, moving at first in company with sensible discrimination, at length parts company with aids of sense, moving along its own path, seeking the invisible, the most abiding. As the range of observation and experience widens, the life itself rises, ever finding as it advances a wider expanse and a greater elevation. Finding within

itself power of insight, as earlier it made use of sense, the rational life unfolds, obtaining by its exercise enlarged visions of existence. Not easily can we describe the very varied exercises of the rational soul, citizen of a kingdom other than the material world. It is vain to speak of 'ideation,' as if the alphabet of speech were enough to construct a science of thought. The famous term need not be cancelled and cast away, it may readily find application; but it is too narrow to express the activity of the rational life. 'Ideation' is too slight a term to contain even the primary conditions of human thought, a term expressive rather of the slighter exercise of the reason than of its grander efforts; suggestive of the gathering of broken pieces of information, rather than of the free movements of a life daily gathering its reward, in fuller understanding of the orderly system of existence.

Thinkers of quite opposite schools are agreed that there is no possible science of Nature which does not distinguish between the material and the spiritual, between that which is known by sense, and that which is known in consciousness. Nature's testimony admits of no doubt as to the reality of these separate spheres. There is little need for calling a multitude of witnesses, but they are within call in any number. Thus, G. H. Lewes has said: 'The sensible comprises but a small portion of that external order which is believed to exist.'[1] Hence, he proceeds to distinguish the sensible world, the extra-sensible world, and the supra-sensible world. Take, on the other hand, the characteristics of the

[1] *Problems of Life*, vol. i. p. 253.

'natural sciences,' and it becomes apparent that they are sectional in their interpretation of Nature. Here are the words of Helmholtz: 'The aim of the natural sciences is to resolve themselves into mechanics,'[1] a statement repeated in analogous terms by Kirchkoff, Wundt, and Haeckel, and generally recognised in the widest interpretation of physics. Within these boundaries the characteristics of rational life are not included. Recent advances in physical science are carrying us towards the conclusion that there is close connection between electricity, magnetism, light, and heat. This conclusion gives greater vividness to the essential contrast presented by the laws appearing in the world of thought. Herbert Spencer has said, thought leads by the pathway of the Knowable, to a 'belief in an Absolute that transcends not only human knowledge, but human conception'; and he alleges that in this belief 'lies the only possible reconciliation of science and religion.'[2] Or shall we turn to a literary authority, less concerned with exactness of scientific distinctions, and more with the amazing complexity of the conditions of human life? Then let us take an extract from Hallam, when he is treating of Pascal's *Thoughts*. 'It might be wandering from the proper subject of these volumes if we were to pause, even shortly, to inquire whether, while the creation of a world so full of evil must ever remain the most inscrutable of mysteries, we might not be led some way in tracing the connection of moral and physical evil in mankind, with his place in that creation; and especially

[1] *Populär-Wissenschaftliche Vorträge*, 1869.
[2] *First Principles*, p. 46.

whether the law of continuity, which it has not pleased his Maker to break with respect to his bodily structure, and which binds that, in the unity of one great type, to the lower forms of animal life by the common conditions of nourishment, reproduction, and self-defence, has not rendered necessary both the physical appetites and the propensities which terminate in self; whether, again, the superior endowments of his intellectual nature, his susceptibility of moral emotion, and of those disinterested affections which, if not exclusively, he far more intensely possesses than any inferior being; above all, the gifts of conscience, and a capacity to know God, might not be expected, even beforehand, by their conflict with the animal passions, to produce some partial inconsistencies, some anomalies, at least, which he could not himself explain, in so compound a being.'[1] These references may suffice to indicate the general drift of thought, from many widely separated regions, flowing into a common channel.

If only the work accomplished by rational power be fully stated, it becomes clear that the most thorough investigations of organic structure and function, fail to supply a scientific account of human procedure.

Darwin has said that 'The lower animals differ from man solely in the almost infinitely larger power of associating together the most diversified sounds and ideas.'[2] This statement of the contrast is inadequate. 'Associating sounds and ideas' is a meagre representation of the ordinary exercises of mind. Formation of ideas must come before their association, and when the earlier process is explained,

[1] *Literature of Europe*, vol. iv. p. 45. [2] *Descent of Man*, p. 85.

the later will appear quite subordinate. Is it true, then, that man has 'almost infinitely larger power of associating sounds and ideas' than animals have? Sounds and ideas may be widely apart. Animals, from birds upwards, are capable of vocalisation. Birds even exercise this power more largely than the higher mammals. The dog and the horse are poor in comparison in powers of vocalising. On the other hand, to classify human language with sound, though not inaccurate, is to exclude the significance of speech. It is as if we were to classify a skilful rendering of a sonata of Beethoven, with the grinding of a corn-mill. Passing next to 'ideas,' it is doubtful whether animals possess ideas in any sense analogous to our 'ideas,' which are representations of objects as distinguished by an aggregate of qualities. Let us, however, grant all this to the higher mammals,—a very liberal concession, surely,—and even then we have an exceedingly narrow statement of the uses of rational power. Let us grant further, that Darwin contemplated a much wider definition of 'idea,' including even our inductive processes, and general conclusions dependent on these, for we do talk in a loose way of our 'ideas' of the order of things in the universe. Perplexity comes now from the other side. How can we attribute to the higher mammals any share in exercise of this kind? He who ventures on this suggestion, encounters the risks consequent on minimising differences, instead of securing the advantages coming from exact statement of data, and deliberate interpretation of procedure. Still greater perplexity lies further afield. If we grant so much to the higher mammals, we are granting to them 'mind,' even if it

be of a lower type than human intelligence. In doing so, we admit an essential difference between sensible discrimination common to all animal life, and intelligent discrimination possible only to the higher mammals and to man.

As to our own powers, we have the certainty of experience. We are conscious of our own rational guidance at once of physical activity, and of thought; we are conscious of deliberate formation of purpose, and of voluntary execution of it; we recognise our responsibility for reflection, for government of passion, and for regulation of conduct. In accordance with knowledge of our own powers, we hold our fellow-men responsible for their conduct. We do not regard even the highest animals as responsible in this way. For us, self-knowledge is so distinct from our organism that we cannot warrantably assign to our organic functions either responsibility for our wrong-doing, or the causality of our well-doing. Our personality is distinct from organic functions which disease may assail. On the testimony of consciousness, including rational discrimination of motives, purpose, laws and ends of action, men of all ages have recognised in themselves a duality of life, physical and rational, and have held more or less clearly a doctrine of the separate existence of the soul. This doctrine seems the only adequate interpretation of the phenomena of human life, distinguishing man from all animal existence, whether it be lower or higher in the scale of organism.

A constructive theory of human life formed on physiological data fails, because of the contrast between sensible discrimination and rational. When

Professor Tyndall suggests that the actions consequent on receipt of a telegram 'are produced by, or associated with, the molecular processes set up by waves of light in a previously prepared brain,'[1] the insufficiency of the causality is very marked. There is a confession of weakness, as there is a confession of uncertainty, in this alternative, 'produced by or associated with.' We reject the former, accepting the latter statement. But, even then, there is not forthcoming any scientific account of the 'previously prepared brain.' Waves of light set up molecular processes, but not reflective processes. When, further, Professor Tyndall objects to the doctrine of the soul, alleging that 'adequate reflection shows that instead of introducing light into our minds, it increases our darkness,' he appeals to us in these words: 'Try to mentally visualise this soul as an entity distinct from the body, and the difficulty immediately appears.' Is not this difficulty an argument against his contention? We constantly recognise what we cannot visualise. Who can visualise the wind, or the conservation of energy, or the laws of Association? Knowledge is gathered by other means than by vision. Professor Tyndall acknowledges that 'adequate reflection' introduces 'light into our minds.' When it is suggested that we attempt to 'mentally visualise' the soul, does not the suggestion imply extended surface, form, and colour, as qualities of the object? Granting that we are able to 'mentally visualise' a tree, or a horse, how can we 'mentally visualise' the mental vision which accomplishes this? A further difficulty remains. In the realm of know-

[1] *Fortnightly Review*, November 1877, p. 593.

ledge, truth which cannot be 'mentally visualised' is ever relatively the grandest. So it is also in the realm of existence. The life highest in the scale of being, highest in nature and in function, is a life which transcends visual representation,—transcends even mental vision. It is no argument against the existence of the eye, that it cannot see itself.

If any one argue that this virtually leaves the soul unknown, the suggestion is manifestly erroneous. Is the eye unknown because it does not see itself? Is it not an axiom of science that existence is known by its manifestations? Nothing is so well known in this way, as we are known to ourselves. Yet this knowledge is distinct from the knowledge we have of our bodily existence, and is quite apart from the data included within physiological science. In saying that rational activity is 'spiritual,' it may be that the meaning lying nearest to us, is only the antithesis of the 'material.' But this is in itself a momentous truth, raising a hard problem for biology, and leading to great issues in the history of human thought. In saying that the soul is spiritual, we say only what stands in correlation with this other saying, that the body is material. Both statements apply to man, referring to the two sides of his nature, manifested together yet distinctly, the lower referable to structure, the higher incapable of being so explained; the lower determined by chemical and mechanical law, the higher moving in conscious recognition of ethical law. If it be said, still the essence of the soul is unknown, we reply, so also is the essence of matter. It is enough for us that existence is known by manifestation of its properties. Adopting the well-chosen language of

Lotze, we say, 'In granting that the essence of the soul is unknown, we do so only in a sense that includes the impossibility of saying what would be the essence of anything in the entire absence of the conditions that are the exciting occasions of its manifestations.'[1]

[1] *Microkosmus*, B. II. chap. ii. § 6; Elizabeth Hamilton's Transl., vol. i. p. 190.

ROYAL BOM... BRANC... OF TH... ASIAT...

CHAPTER VII

ANIMAL AND RATIONAL INTELLIGENCE

After this general account of the rational activity of man, we return to consider the evidence of intelligence in animals, specially in the higher mammals. We have seen that only by prior study of the higher intelligence can we come to any clear appreciation of the lower intelligence. Our dependence on consciousness for direct knowledge of intelligence is conclusive as to the line of research.

Our aim here will be to estimate facts at their highest value, as they may seem favourable to the hypothesis of evolution of mind as well as of body. This is the only course by which we may hope to approximate towards a decision on the relations of rational life to animal in natural history.

We begin with an extract from Wallace's *Darwinism*: 'Mr. Darwin's mode of argument consists in showing that the rudiments of most, if not of all, the mental and moral qualities of man can be detected in some animals. The manifestations of intelligence, amounting in some cases to distinct acts of reasoning, in many animals, are adduced as exhibiting in a much less degree the intelligence and reason of man. Instances of curiosity, imitation, attention, wonder, and

memory are given; while examples also are adduced which may be interpreted as proving that animals exhibit kindness to their fellows, or manifest pride, contempt, or shame. Some are said to have the rudiments of language, because they utter several different sounds, each of which has a definite meaning to their fellows or to their young; others, the rudiments of arithmetic, because they seem to count and to remember up to 3, 4, and even 5. A sense of beauty is imputed to them on account of their own bright colours, or the use of coloured objects in their nests; while dogs, cats, and horses are said to have imagination, because they appear to be disturbed by dreams. Even some distant approach to the rudiments of religion is said to be found in the deep love and complete submission of a dog to his master.'[1]

This summary of evidence will prove valuable for guiding us in the attempt to thread our way through a vast mass of illustration, so extremely varied in form as to make classification exceedingly difficult. The summary is the more helpful that it has been drawn up as the result of close study of Darwin's works, by one in the highest sense competent for the task. My object will be to estimate the evidence adduced, seeking to approximate towards definite conclusions as to the characteristics of animal intelligence, thus preparing for comparison of it with human intelligence. In entering upon this division of the subject, it is to be observed that Darwin in his 'comparison of the mental powers of man and the lower animals,'[2] is content to limit the range of observation by restricting to the higher animals, most

[1] *Darwiniem*, p. 461. [2] *The Descent of Man*, chap. iii. p. 65.

closely approaching man in physical structure. He says: 'My object in this chapter is to show that there is no fundamental difference between man and the higher mammals in their mental faculties.'[1] This is contemplated by Darwin as part of the constructive argument for the evolution of rational life. It is also desirable here to keep in view Wallace's own position, as marking divergence from Darwin at this point. He says: 'I fully accept Mr. Darwin's conclusion as to the essential identity of man's bodily structure with that of the higher mammalia;' yet he finds himself unable to concur in the further conclusion as to the essential identity of man's mental nature with that of lower orders of life. As to Darwin's position concerning the rational life of man, Wallace says: 'Although, perhaps, nowhere distinctly formulated, his whole argument tends to the conclusion that man's entire nature, and all his faculties, whether moral, intellectual, or spiritual, have been derived from their rudiments in the lower animals, in the same manner, and by the action of the same general laws, as his physical structure has been derived.'[2] As to the validity of this, Wallace says: 'This conclusion appears to me not to be supported by adequate evidence, and to be directly opposed to many well ascertained facts.'[3] Thus the two authors who divide the honours of working out, quite independently, a theory of the evolution of organic life by natural selection, are at variance as to the possibility of including the rational life of man in the scheme.

As I have elsewhere discussed in detail the evidence

[1] *The Descent of Man*, chap. iii. p. 66.
[2] *Darwinism*, p. 461. [3] *Ibid.*, p. 461.

for intelligence in animal life,[1] I shall best meet the requirements of the present argument by giving prominence to definite generalisations from the data supplied. The evidence has been largely accumulated, and is now generally accessible in literature. There is, therefore, good reason for anticipating a solid basis of agreement here, even though the difficulties of the inquiry are such as to preclude the hope of an exhaustive discussion. We shall never wholly escape the perplexities arising from difference between the indirect mode of knowing how animals act, and the direct knowledge of our own intellectual procedure. External observation has no chance of competing on this field with consciousness of individual experience. Nothing but defective appreciation of the difference in the conditions of knowing, can induce any one to suppose that it is possible to reach conclusions as to animal intelligence with the certainty attainable as to human intelligence. We know beyond doubt what are the characteristics of rational power in man; we can never know, except by very imperfect inductions, what powers of intelligence are at work in animal life. There is, moreover, this additional obstacle to exact inference, that the certainty as to our own procedure, over against the uncertainty as to animal procedure, leads us to reason largely by analogy, without our having any strict test of the legitimacy of the analogical inference. All these limitations and disadvantages must be kept in view, if scientific conclusions are to be sought with reasonable hope of success. Full weight must, therefore, be given to

[1] *The Relations of Mind and Brain*, chap. vii. pp. 198-288. Revised treatment of the question appears in the 3rd edition.

these preliminary statements, in attempting to trace our path from the shell-fish to man, searching for the appearance of intelligence.

The initial perplexity attaching to this inquiry is the difficulty of finding a reliable definition of 'intelligence,' such as will be accepted by all inquirers. This difficulty is, however, greatly lessened by the course we have followed in drawing the distinction between sensory discrimination and rational discrimination. There is a clear line of demarcation here, without regard to which it is impossible to advance a single step in our research as to animal intelligence; and there is this further advantage that the distinction is matter of general agreement. The only modification of this claim to agreement arises from the contention of those who would identify mind with sensibility, or, in case of regarding these as distinct, would make them always co-existent in natural history. Under this hypothesis life and intelligence are either identical or synchronous. Very few among scientific observers are prepared for such a position.[1] Darwin separates himself from this completely, by restricting reference to the higher mammalia, when he seeks to construct a theory of the evolution of man's 'mental powers.' This is not on his part an expedient for restricting the range of comparison. Such restriction might well be desired by any one contemplating the serious entanglements

[1] So stated, biological theory seems to pass into the monistic scheme of Hegel, as in a dissolving view. The Universe is interpreted, not only as the manifestation of creative intelligence, but as the direct action of intelligence, manifesting itself in gradually expanding rationalised forms.

involved by including the whole range of animal activity. But this is not the consideration which has influenced Darwin. His restriction to 'the higher mammalia' arises from the structure of an evolution theory. Within such a theory, evolution of organic structure from its simplest form upwards, towards a more highly elaborated organism, constitutes a vast epoch in the history of progress, carrying within itself, under operation of natural law, provision for the life of a later epoch. According to the implications of this theory, the evolution of 'mind' is a late event, for which all antecedent stages in natural history had been preparing. This is, indeed, the meaning of 'natural selection.' It is the action of environment on organism, constitutionally adapted for modification under pressure of external demands. This, according to Darwin, is the key to the progress manifest in the annals of natural history. Hence the restriction to the higher mammals, when inclusion of the functions of human life is attempted. On the other hand, when Wallace admits his inability to claim that the rational life can be included within this scheme of evolution, it is because he fails to find, in the forms of life most closely allied, sufficient promise to account for evolution of the mental powers of man.

Granting evolution of organic life on the earth, what account can be given of the appearance of 'mind' or 'intelligence'? In the contrast between sensible discrimination and rational, we have a serviceable definition of 'intelligence.' It seems also as if in advancing into this higher field of research, we were passing away from organic structure and its functions, inasmuch as physiology of brain has

failed to localise rational functions, by planting them in structure. If this be so, the theory of Evolution, as an argument for continuity of life, is involved in serious difficulty, in its attempt to include rational life. Has not Darwin been over sanguine in his view of analogies? Has not Wallace shown himself more strict in adherence to scientific conditions? How the matter stands, will depend on the conclusions warranted by study of the relations of human intelligence to animal life.

In the contrast between sensible discrimination and rational, we have a definition of 'intelligence,' not only compatible with the theory of Evolution, but even suggested by it. The scientific view of the structure and functions of the sensori-motor system leads forward to a boundary-line beyond which lies a new phase of activity. In touching the limits of sensibility, we forthwith recognise the action of a higher life. Power of reasoning is the central feature, typical of this higher order of power. Negatively, 'intelligence' is non-sensible discrimination,—a distinguishing of difference to which sensibility is unequal. Positively, 'intelligence' is discrimination of the meaning of sensible impressions. This is its simplest form of exercise, beyond which lies all that is involved in dealing inductively with the problems of existence.

That there is in the life of the higher mammalia more than merely sensible experience, is generally admitted. We cannot grant higher functions, without granting higher faculty. Intelligence, even in its simplest phase, transcends sensibility, involving discrimination of the objective significance of sensory impressions. By this higher exercise, sensible dis-

crimination is utilised so as to provide a higher knowledge. Thus, in our own experience, the two powers, sensibility and understanding, co-operate in securing a two-fold knowledge, easily distinguished,—consciousness of sensation, and knowledge of its significance. The sensory impression is one thing; its objective significance is quite another thing. That the impression may be complex does not affect this distinction. 'Any number of impressions from any number of sensory sources, falling simultaneously on a mind which has not yet experienced them separately, will yield a single undivided object to that mind.'[1] 'The noticing of any part whatever of our object is an act of discrimination.'[2] We discriminate objects, and parts of objects. We contemplate present sensory experience in the light of past experience. Only in this way, can the meaning of the present sensory experience be apprehended. Thus, by a power of comparison, with memory, and use of the law of causality, we have a knowledge of the qualities of objects coming into contact with our organism. Sensibility is the pre-requisite for such knowledge, but it is insufficient for its attainment. Sensible discrimination is the limit of experience for a great portion of organic life on the earth. With us, it is otherwise. Consequent on touching an object, or being touched by an object, we have a knowledge of the object itself, as a thing separate from other objects around. The difference between sensible discrimination and intelligent, is known within the lines of our own experience. When we touch one object, and im-

[1] *Text-Book of Psychology*, by William James, p. 245.
[2] *Ibid.*, p. 244.

mediately thereafter touch another object, we feel the difference; when we say the first object is a chair, the second a book, this is intelligent discrimination.

Let us, then, put the two forms of definition together. Intelligence is non-sensible, because supra-sensible, recognition of difference; a discrimination transcending sensible experience. Intelligence is interpretation of sensible experience itself, so as to recognise its objective significance. The former definition excludes what sensory apparatus supplies, treating sensible experience as preliminary to knowledge proper. The latter makes interpretation of sensible impressions the simplest phase of intelligent life. More advanced phases appear in the attaining of rationalised knowledge. These definitions include animal intelligence along with human. A common basis of intelligence belongs to both. To man alone belongs the free exercise of rational power, seeking interpretation of existence, in all its forms and relations. How much is to be made of this difference is the next question. The definition of intelligence is secured by reference to the limits of sensory apparatus on the one hand, and to our conscious self-directed mental activity on the other. Every life which passes beyond sensible experience to distinguish parts of objects, and the several qualities of objects, exercises a measure of intelligence. Still higher than this, is the rational life, proceeding by inductive process to the recognition of general truth. The life so exercised gathers knowledge and passes more or less freely into a sphere of truth, distinct from that included within the sphere of experience. That some animals are equal to the lower exercise of

intelligence, almost all are prepared to admit, whatever the diversities of opinion entertained as to the range of intelligent power belonging to animal life.

How far we may extend the group of 'higher mammalia' to which intelligence may be attributed, is a question of great interest here. But it does not promise to find exact settlement under the conditions of our present knowledge. For theoretic purposes, it is enough that we consider the relations of man, as an intelligent being, to the animals nearest in organisation, and most closely allied by domestication. The group thus formed is sufficiently large to allow for an extended range of evidence, and for critical acumen in its interpretation. Here allowance must constantly be made for the imperfect knowledge of animal life attainable by outward observation. The group of animals contemplated includes the ape, the monkey, the dog, and the horse. For our present object, it is not needful to extend wider. Let us take the highest in animal life, even with all the advantages of domestication, and let us compare this with the normal intelligence of human life.

We are now ready for consideration of Darwin's argument. The summary given by Wallace, already quoted, will greatly facilitate reference, and will afford a reliable test. What we specially desire to reach is a set of trustworthy generalisations as to animal intelligence. Only after these have been found can we be in a position to judge of the scheme of Evolution, as it bears upon man's appearance on the earth.

Under guidance of physiology we have to assign the full complement of work to the sensory nerves and correlated portions of the brain and subordinate

nerve centres. Without this, the terms of the problem concerning intelligence cannot be stated.

It is generally admitted that sensibility is the only phase of discrimination possible for the lower forms of life. This is implied in the reference to the higher mammals as intelligent. Such reference to the highest types of animal is in harmony with the form of the argument for evolution.

Our difficulties are thus considerably lessened, first, by exclusion of most animals, and also by exclusion of a large mass of correlated facts in the life of higher animals and also of men. It is alleged that man and the higher mammalia are capable of intelligent discrimination. At the same time, it is admitted that there is no deviation from this law, that sensible experience is to be assigned to sensory apparatus. The key to such experience is physiological function. Here we are moving upon strictly scientific lines, and the results have an important bearing on the terms of the main problem.

The direction to be followed now becomes more obvious. The phenomena of sensibility being classified and separated, the phenomena of intelligence alone remain to be interpreted. Let us observe the bearing of this on life experience. Much in animal life that is commonly assigned to intelligence, is withdrawn, as having no such significance as has often been supposed. If the antennæ of the ant are more sensitive than the tips of our fingers, larger power of discrimination by touch must be attributed to the ant than to man. That the ant is far below the higher mammals in the scale of life, involves no detraction from this acknowledgment of superiority to man him-

self. Again, inasmuch as the dog has a prominent olfactory lobe, outstretching the frontal lobes of the brain, and has greatly more acute sense of smell than we have, we assign to him superiority to man in this phase of sensory experience. Thus, when sensory structure becomes the test of comparison, cross classifications are inevitable, involving collateral issues. It is impossible to distribute capacity of sensibility in accordance with an animal's position in the scale of animate existence. Great differences in structure of sensory organs, and consequently in sensible experience, appear at various points. The examples given are conclusive. With this is included the inference, that increased sensibility bears no testimony for intelligence. Power of discrimination by means of apparatus, cannot support an inference in favour of the existence of intelligent discrimination. Sensibility, even though it be superior to that of humanity, does not of itself imply power of that higher kind which we attribute to the higher mammals. The superiority of touch belonging to the ant, in comparison with that belonging to the dog, is manifest. On the other hand, evidence for intelligence in the dog is obtained by external observation. It is connected mainly with the animal's interpretation of signs, as when the collie extends his run at the shepherd's call. This presents our first generalisation. Sensibility to contact with external objects is common to all organic life on the earth, and is a thing distinct from intelligence. Difference of sensibility depends upon difference of structure, and upon nothing besides. There are no data on which it is possible to modify this conclusion. Morphology of sensory structure does not guide to a science of

intelligence. As it is impossible from superiority of sensory apparatus, and correlative superiority in brain structure, to infer intelligence, so is it impossible from approximation of structure in the higher mammals to argue towards similarity of intelligence.

What holds true of superiority of sensory apparatus, holds of superiority in brain structure. These are correlated. Whenever sensory apparatus is superior, there brain structure is correspondingly so. Hence Darwin's saying, 'The brain of an ant is one of the most marvellous atoms of matter in the world, perhaps more so than the brain of a man.'[1] What the brain of an ant does, is to provide for the functional activity of the marvellous differentiated sensory structure appearing in the antennæ, or jointed feelers, projecting from the head; and further, to co-ordinate impressions received by these feelers, so as to direct the activity of the life. This is true of the ant, just as it is true of the functions of brain in every case.[2] The same functions are fulfilled by the brain in the life of the dog, and in the life of man. All brains are alike in this, that they provide for functional activity of sensory and of motor apparatus; and that they co-ordinate impressions in such a manner as to provide for bodily activity. The brain of the ant is marvellous as compared with that of the dog. When next the resemblance of the dog's brain to man's brain is considered; and the still closer resemblance of the ape's brain to the human brain; and when, further, the contrasts of these three are considered, it does not appear that we can account structurally for the superior intelligence of the dog.

This seriously affects the validity of Darwin's infer-

[1] *Descent of Man*, p. 54. [2] *Ibid.*, p. 6.

ence from analogies of 'bodily structure.' When referring to the analogy in fissures and folds of the brain of the orang and of man, and remarking that they do not perfectly agree, Darwin adds, 'Nor could perfect agreement be expected, for otherwise their mental powers would have been the same.' There is a fallacy here, seriously affecting the whole argument. Inference from structure to intelligence—or from intelligence to structure—is not warranted on evidence. Intelligence has not been scientifically traced to structure, as sensibility has been, as co-ordination of impressions has been, as excitation of motor action has been. In accumulating evidence for the doctrine of continuity, we have not been able to include the phenomena of intelligence. These phenomena are not even known by study of organism; and have not been classified with structural functions.

There is, indeed, little wonder that success in working out a theory of continuity of organism, has stimulated expectation that the law of continuity would yet include intelligence also. But a belief of this kind has no scientific value. Science depends on evidence, whereas evidence in support of this belief is not at command. We have been guided by embryology, by rudimentary organs, by 'homological construction of the whole frame' in bones, muscles, and sense organs; by evidence for structural modification under a law of 'natural selection,' favoured by the law improving structure by its use, and by clear proof in favour of localisation of sensory and motor centres in the brain. But in all this there is no trace of evidence in support of the admitted fact that a measure of intelligence belongs to the

higher mammalia, or for the fact that rational intelligence belongs to man.

This is a critical point in the argument. Looking at a dog's brain, we can tell that the animal has been capable of sensory experience, and of locomotion; and has been distinguished by prominence of the sense of smell. But, with the evidence lying before us in this structure, we cannot tell that the animal was intelligent. The evidence on which we attribute intelligence to the higher mammals is not included within morphology and physiology. Evidence for their classification as mammals is clearly within the compass of these sciences; evidence for their intelligence is not. For this we are dependent *exclusively* on observation of the conduct of the animal under our direction. After we have satisfied ourselves that the animal understands our signs, and carries out our wishes, we look in vain within the structure for evidence of the power of understanding we observe. Science has no testimony on this point. Everything said as to brain-power accounting for the dog's intelligence, rests on conjecture, not on scientific evidence. The argument from brain structure to intelligence must be withdrawn. There is only one line of advance for a scientific argument for continuity, that it be shown that the new function has been contemporaneous with new structure, and that the later function, having been evolved from the earlier, the advance has been continuous. On clearest evidence, sensory experience belongs to all organism; and diversity of experience depends on differentiation in structure. On the other hand, Intelligence is certainly to be attributed to the higher animals, but

on what this possession depends, science has no testimony to offer.

Thus it appears that for study of the phenomena of intelligence, we must pass away from research into organic structure and function. We must pass into consciousness. Here alone, direct knowledge is to be obtained of mental phenomena. The distinction between the two modes of inquiry is clear, and all that has been already said as to guarding against the intrusion of the one into the sphere of the other, is confirmed. We are studying human experience in order to reach definite conclusions as to animal experience. For success, we require a more rigid separation of sensory experience from intelligent discrimination, as both appear in human life. So predominant is intellectual activity in human history, that it is not habitual with us to distinguish rigidly between physical and mental contributions to our experience. But the distinction needs to be rigidly drawn here. The broad lines of separation are manifest in action, such as between food and knowledge, between muscular exercise and reflective, between observation of the external world, and the succession of fancy and feeling in our consciousness. We do not commonly attempt to trace for ourselves how much is to be attributed to organism, how much to intelligence, when we admire a flower, or express an opinion, or resolve to check an evil habit. As long as the one side is prominent, whether it be physical or mental, we readily distinguish the one from the other. But when contributions from both sides intermingle, we do not easily discriminate, and not infrequently our entire experience is attributed to

mind when a large admixture of physical activity and experience is essential. This arises naturally from the fact that we have no direct knowledge of the working of brain and nerve, even when both are in constant use. Hence we have to distinguish between what is directly known in consciousness, though standing unexplained by science; and what is essential to our experience, yet known only by scientific discovery, not by experience. The latest results of physiological science have pressed into notice the difference between the two phases of activity, and the need for first explaining each separately, in order afterwards to explain their relation. When we would interpret the action of human intelligence, and thereby approximate towards some clearer view of animal intelligence, all that belongs to the structure and functions of our sensori-motor system, including the correlated structure and functions of the brain and subordinate centres, is to be laid aside as unavailable. The only form of dubiety hanging over our procedure, arises from possible undiscovered brain functions, or functions of inferior central bodies. But, admitting that science has not yet completed interpretation of brain functions, since 'silent regions' stand unexplained, it must be allowed that help cannot come in this way towards solution of our problem. Direct knowledge must determine our conclusions. We must work towards inferences in the light of ascertained facts. From the knowledge of our own intelligent procedure, we must attempt an inference adequate for explanation of what we take to be the intelligence of the higher mammals; and in order that the validity

of such inference may be carefully guarded, we must distinguish as sharply as possible between physical function and mental action in human life itself.

Advancing on these lines, we are ready for a survey of the data on which Darwin relies for inclusion of mental powers with physical, within a theory accounting for differentiation of organic life by natural selection, under laws applicable to the whole scale of animate existence. Wallace's summary includes manifestations of intelligence, amounting in some cases to distinct acts of reasoning, curiosity, imitation, attention, wonder, memory, kindness, pride, contempt, shame, rudiments of language, and of arithmetic, a sense of beauty, power of imagination, and rudiments of religion. The list is a considerable one, though compiled with little regard to the comparative value of the things enumerated. The evidence adduced must be our guide to interpretation. We greatly need more exact understanding of the actions contemplated and of the terms employed. This may be sought, however, with some degree of hopefulness, because there is at least a general concurrence in the statements made. The question is, how far does the evidence carry us in our transference of the language of man to the experience and actions of the higher mammals?

The method to be followed is clear. We must compare the higher mammals with man, making their *actions* the test of possible inferences. On one side, we must accumulate all the evidence for intelligence appearing in the life of the animals, specially that supplied by the observations of naturalists; and also all testimony as to structure and

functions of nerve and brain, coming from the department of experimental psychology. On the other side, we must present all that consciousness discloses as to our own intelligent procedure. Careful comparison of the two orders of life, as far as this proves possible on the evidence obtained, is the only course open for scientific inquiry. Comparative structure of the nerve-systems and brains has been accurately ascertained. A close resemblance exists in this respect. A comparison of the actions of an animal, such as the dog, with the actions of man, does not involve serious difficulty. Selection of the dog for the test is warranted on many grounds, as it is the animal best known to us, in closest companionship with us, and the one to which direct reference is made by Darwin for 'the rudiments of religion.' The difficulty arising from the indirectness of our knowledge of animal intelligence is insuperable. The direct knowledge of our own reflective exercise, given in our own consciousness, must be the test for inference as to the intelligence of the dog. Observations of the dog's action must be interpreted by reference to our observations of our own understanding and experience. These are the fixed conditions of the present inquiry. The difficulties belonging to such a mode of inquiry are many; but no easier method is available. On the assumption that there is some manifestation of intelligence in the dog, we seek to reach a psychology, or doctrine of mind or soul, in this animal, which has become the close companion of man. In this way only, can advance be made towards the double conclusion we desire to have explicitly stated, as to what animal

intelligence includes, and wherein it differs from human intelligence.

In entering upon this department of comparative psychology, the question whether psychology is 'a natural science' must be laid aside as of no importance. The question concerns nothing more than the matter of naming, and we shall have to determine verbal usage according to the conclusions reached. In dealing with structure, functions, and their scientific interpretation, the suitableness of our employment of terms must be settled by the results of investigation. If any one say that 'natural science' closes with application of the microscope, it is certain that external observations are closed at this limit. On the other hand, if man belongs to Nature, and consciousness belongs to man, the study of our own consciousness lies within the sphere of natural science. When from this we turn to judge of 'mental phenomena' in the life of a dog, we are clearly in the region of natural science. Either this must be admitted, or the claim to include man within Nature must be given up. There is no alternative. That the inclusion of the whole life of man, bodily and mental, within Nature, is the only tenable position, is beyond dispute. The distinction between external observation and consciousness, as two distinct modes of knowing natural phenomena, is, however, rigidly drawn. It is acknowledged that there is no available mode of bridging the chasm which separates them. In our own life, they are distinct; and their relation to each other can be judged from the facts of our life alone. The contrast between physiology and psychology is final, and must regulate biological

research here. As far as physiology can travel, organic functions are included; whenever interpretations of sensory impressions are detected, 'mental phenomena' are recorded, and psychology is begun. All fighting against this severance is vain. If the dog manifests intelligence, there must be a psychology of dog-life. Such a psychology cannot be constructed on physiological data, but only on a careful comparison of the actions of the dog with our own actions. The interpretation will therefore hang entirely upon our interpretation of the facts of our own consciousness, as these may guide to interpretation of the dog's actions.

In this way, under demands of comparative biology, we reach a clear understanding of the distinctive character of 'mental phenomena.' They are such phenomena, in whatever life found, as transcend the functions of organism. In the language of experience, they are phenomena in advance of sensory discrimination, inasmuch as they imply its interpretation. In language applicable to action, they are phenomena superior to the operation of motor apparatus, including brain and nerve and muscle, the action of all three being included within physiology. Among 'mental phenomena' these are conspicuous, guiding us in all inferences as to 'mind' or 'soul,'—interpretations of sensory experience, and intelligent purpose, formed in view of the relations of means to ends. Wherever vital phenomena show more than action and reaction of sensory apparatus; and more than motor activity in response to sensory impression and appetite, there we have a psychological problem. Such a problem, we are agreed, does arise in the life of the monkey, ape, horse, and dog. It must, therefore, be clearly seen

that this admission is involved in the acknowledgment of 'animal intelligence.' This is the affirmation that 'intelligence,' in some phase, appears lower than man in biological history. And this is the admission of life of an aspect higher than the physical. In effect, it is the affirmation that the higher mammalia,—expressly the four species enumerated,—are possessed of 'mind' or 'soul' of some type, akin to that of man, however inferior it be in the range of its powers. This is the point to which we have been brought by recent advances. Scientific observers must recognise the breadth of their own conclusions, and we must face the problem which has been raised. That this can be done without careful scrutiny of our own consciousness, is impossible. All those who have been loudest in the outcry against 'introspection' must adopt introspection as the sole mode for reaching any conclusion as to the problem of 'animal intelligence,' as this has been shaped by biological research.

Two rules of procedure must here regulate us,—*First*, 'Animal intelligence' can be judged of only by reference to our own consciousness of intelligent procedure. *Second*, Animal conduct unattainable by us, even by the best use of our intelligence, cannot be referred to intelligence.

Our first aid towards classification of mental phenomena is to be found in *the contrast between lower and higher orders of life.* The exact line of severance may be difficult to trace, but if the contrast be granted so far as to set the lower orders of life on one side, and the higher mammalia on the other, we have scope for induction. When Darwin undertakes 'to show that there is no fundamental difference

between man and the higher mammals in their mental faculties,'[1] we recognise this contrast. Consistency here will lead to important results. While, however, Darwin makes the contrast conspicuous when defining the limits within which he undertakes to lead proof, he unfortunately does not adhere to these limits in course of his argument. Such adherence on the part of an observer so disciplined, and so exact in statement, would have yielded large help in the discussion. He has, however, at least suggested the essential conditions of our inquiry. Yet these conditions are well-nigh obliterated in his own treatment of the question, immediately after he has passed from their announcement. Thus, one of his first statements concerns 'animals very low in the scale,' namely, 'that their mental powers are much higher than might have been expected.'[2] Reference is next made to 'animals of many kinds, including birds,' when it is alleged that 'individuals differ greatly in every mental characteristic.' Forthwith, he touches the problem concerning the manner in which 'the mental powers were first developed in the lowest organisms,' declaring this 'as hopeless an inquiry as how life itself first originated.' Immediately thereafter he passes to animal Instinct. Founding on the observations of Pouchet,[3] he says, 'Those insects which possess the most wonderful instincts are certainly the most intelligent,' while 'in the invertebrate series,' fishes and amphibians are described as 'the least intelligent members.'[4]

[1] *The Descent of Man*, p. 66.
[2] *Ibid.* p. 66.
[3] *Revue des Deux Mondes*, Feb. 1870, p. 690.
[4] *The Descent of Man*, p. 67.

No true scientific advance can be made by reasoning conducted on these lines. There are two theories included, one of which must be abandoned if the other is to be vindicated. If 'the object is to show that there is no fundamental difference between man and the higher mammals in their mental faculties,' it seems implied that there is a fundamental difference between man and the lower mammals, else there is no need for drawing the line. On the other hand, if 'mental powers' are to be attributed to 'animals very low in the scale,' we need some better understanding of what is 'mental.' Is there no fundamental difference between man and such animals in their mental faculties? If there be none, the whole range of the scale is before us, and the evidence must be stated much more effectively than has yet been done. The facts to be attributed to the sensori-motor system in fishes, amphibians, and insects must be distinguished from those facts in their life which are attributed to 'mental faculties.' No biologist has attempted this needful distinction. If only we begin with fishes and amphibians, and thence move downwards, the hopelessness of the claim becomes manifest. This arises from the impossibility of claiming, for animals lowest in the scale, anything higher than powers of sensibility.

If there were any considerable consensus of opinion among scientific men, attributing intelligence to animals very low in the scale, it would be inconsistent to concentrate on exclusive references such as those by which Darwin defined his object in the chapter on 'the mental powers of man and the lower animals.' The definition of intelligence must be explicit, if any scientific conclusion is to be reached as to its appearance.

It is scientifically assured that sensori-motor functions are not functions of intelligence. Intelligence is at least the power of discrimination which interprets sensible differences. Recognising this contrast between organic sensibility and intelligent discrimination, we seek a careful classification of data on which theoretic discussion may proceed.

Believing that Darwin was correct in limiting his object to showing that possession of intelligence must be predicated of the higher mammals as well as of man, I take it as a correlative position that intelligence, as here defined, cannot be attributed to lower organic life. The implications of this position must, however, be clearly recognised. It follows from this that evidence is not available to sustain the conclusion that fishes and amphibians manifest intelligence. On the other hand, reference to the wonderful phenomena of insect life shows that greater powers of sensory discrimination belong to insects than to fishes and amphibians; or even to the higher mammals. In view of these differences, either there are two distinct bases for classification of life supplied by sensory discrimination and by intelligence, or we must assign a higher intelligence to insects than to the higher mammalia. The difficulty here must be deliberately met. A scientific account of the appearance of intelligence in the world's history, depends on what is to be said of the Insects. Has intelligence made its appearance at this low point in the scale of organic life? Does it appear where we have a brain weighing 'a fraction of a millogramme;' or was Darwin correct in bringing the whole discussion to a possession belonging exclusively to man and the higher mammalia?

It is most natural for us, as it is the simplest course, to attribute to Intelligence the wonderful activity of the ant. It is certain that without use of our intelligence we could not accomplish what the ants do. But, the limits to their work are so marked as to show the lack of intelligence, and to lead us to classify their actions otherwise. Lubbock's observations supply marked testimony as to these limits. Marvellous sensibility accounts for much, and beyond this, there is action manifestly uninstructed, untrained, unreflective. Any reserve which seems needful in view of the observations of Huber, Lubbock, Pouchet, M'Cook, and others, must be attributed to the indirectness of the knowledge attainable by us. Sensibility and instinct together, apart from intelligence, seem capable of accounting for most of the observations. How 'instinct' is to be regarded, will appear presently. The recorded observations are so many and striking that it is impossible to assign to them any other than a conspicuous place in discussion of the problems of animal intelligence. The affirmation or denial of intelligence here, becomes a turning-point, round which definite theoretic conclusions must gather. If intelligence may with full warrant be attributed to ants, the argument for continuity is broken. We place insects high in intelligence, while we place fishes and amphibians low. On the other hand, if we deny intelligence to the insects, we have the most wonderful testimony to the possibilities of sensibility and instinct, and on this account the testimony for intelligence in the higher mammals is greatly narrowed. Either intelligence appears so low in the scale of life as to break continuity, or its appearance

at the highest stages of organic development is in a restricted and quite subordinate mode. In any case, the ant must be regarded as superior in sensibility to the higher mammals, and even to man,—a conclusion in itself of large significance as bearing on the problems of evolution. Observations as to the ant show that the possibilities of sensible discrimination are so largely extended, as to suggest a considerable expansion of our conceptions of the area of physiological functions. As to intelligence itself, our conclusion brings us back to comparison of the higher mammals with man, in accordance with the object avowed by Darwin in his 'comparison of the mental powers of man and the lower animals.'

It is now sufficiently obvious that all sensory phenomena, and all forms of activity traceable to nerve sensibility, must be placed on one side, in order that the phenomena of intelligence may be classified. For accomplishment of this, some closer test of intelligence is required, by a more rigid application of the contrast between the two phases of discrimination. This can best be attained, by proceeding from the higher life to the lower, that is, from direct knowledge of mental activity, to inductions warranted on the basis of an indirect knowledge.

That this may be attempted with some degree of confidence, we must have full in view all that is common to man, as animal, with the higher mammals, making account of close approximation in organic structure. Here, two quotations from Darwin will render important service. 'As man possesses the same senses as the lower animals, his fundamental intuitions must be the same. Man has also some few

instincts in common, as that of self-preservation, sexual love, the love of the mother for her new-born offspring, the desire possessed by the latter to suck, and so forth. But man, perhaps, has somewhat fewer instincts than those possessed by the animals which come next to him in the series.'[1] Next, as to intellectual power,—'Man, from the activity of his mental faculties, cannot avoid reflection: past impressions and images are incessantly and clearly passing through his mind.'[2] To separate two distinct sets of phenomena, thus becomes needful, if valid inductions are to be reached; and this demand applies as much to the higher mammals as to man. This requirement is to be met by application of the distinction between sense and intelligence,—between 'fundamental intuitions' of the senses, and 'reflection,' as Darwin has expressed the difference. For a little, we leave common instincts, to ascertain what is common in use of general sensibility of the organism, and of the special senses; thereafter, what is common in respect of intelligence, and what are the special characteristics of human intelligence.

As to organic sensibility, inference is easy, giving large experience and activity common to man and animal. Continuity in structure is obvious; the functions are homologous; and diversity is to be affirmed only in accordance with differentiation in organism. The laws of sensibility and of motor activity are the same; and whatever differences exist in experience determined by the special senses, all alike see, hear, taste, and smell.

As to Intelligence, inference is more difficult, the

[1] *The Descent of Man*, p. 66. [2] *Ibid.* p. 112.

need being much greater for classification of phenomena, and distinction of function. Our inferences must be from the higher to the lower,—from the better known to the less known,—from direct knowledge to the interpretation of the results gathered by indirect observation. From the inquiry already passed, it follows that a greater amount of human experience and activity must be assigned to organism under physiological law, than is commonly done, when interpretation depends on the knowledge which consciousness supplies, apart from knowledge of the function of the sensori-motor system. The importance of this will appear from a few illustrations. Take mechanical skill, in which man immeasurably excels the animals nearest to him. Iindustrial art supplies examples of the contrast between thought and muscular facility. The man must observe the conditions of work, must take pains in course of his first efforts, must shape successive purposes in acknowledgment of his failures, must acquire muscular aptitude. Afterwards there is less need for thought. So it is with vocalisation in early attempts to speak.[1] Imitation of sounds plays a preliminary part; next, understanding of symbols before they can be used; and thereafter, by slow effort, management of the brain centres, the nerves, and the muscles, with vocal cords of the larynx, all of which are brought under regulation only by intelligent purpose to imitate a familiar vocable, without the slightest knowledge of this elaborate structure provided to secure this result. From these forms of effort, it appears that imitation is first favoured by sensory impression. This is obviously

[1] See *The Mind of the Child*, Part II., by Prof. Preyer, Jena.

common to man and animals, even animals much lower in the scale than the higher mammals. Passing to understanding of symbols, we are led to further distinctions, involving more obvious approach in the life of the higher mammals towards human exercise, than has appeared in the life of lower orders. We are now crossing the lines between sensory and intelligent appreciation. Poultry can appreciate a call associated with food-supply—an association powerful in all animate existence endowed with sense of hearing. In advance of this, warranting special classification, the monkey, the ape, the horse, and the dog show intelligent discrimination by interpretation of signs. Each of them, however, quickly reaches the limits of its power. A dog understands vocables as symbols of command; but he does not attempt an intelligent exercise like the child's, preliminary to vocalisation. The full explanation of this does not seem in any case to be physical incapacity, for the physical organism of the dog or monkey is equal to vocalisation, as is organism much lower in the scale, extending probably even to fishes and to insects. From the level of the birds upwards, vocalisation certainly expresses feelings of pleasure, want, and fear. This is well illustrated by Mr. Garner's experiments as to the language of monkeys, with aid of phonograph. The author gives a humorous sketch of his attempts at definition of the meaning of sounds.[1] On the data now referred to, certain inductions become clear: Sensory associations, and power of vocalisation belonging to organism. With these is included a phase of memory, with increasing sensibility

[1] *The Speech of Monkeys*, by R. L. Garner.

to sound as a stimulant of action. In proof of exercise of intelligence, examples are many and familiar, making it unnecessary to enter upon detailed references.[1] As to human intelligence, evidence connected with physical aptitude, beginning with human speech as the expression of thought, passes upwards through all the acquisitions and achievements connected with skilful manipulation, and with development of musical gift and artistic faculty. Within this department of inquiry evidence is supplied sustaining the conclusion, that the higher mammals possess a form of intelligence sufficient for interpreting other symbols, besides the expressions of sensibility belonging to the natural life of their species. The dog is conspicuous here, standing in marked advance of the other members of the group, monkeys, apes, and horses. This superiority is the result of companionship with man. Possibilities of training thus become a valuable test of comparative intelligence.

From this we pass to an additional group of phenomena connected with the social life characteristic of the several species. This transition somewhat alters the view of the classifications of animals. In so far as gregarious tendencies involve a more uniform and extended manifestation of social feeling, sheep and oxen take precedence of the higher mammals. Within the higher group, monkeys take precedence of the apes; while horses and dogs supply less valuable evidence of social feeling. Domestication has considerably obscured the range of natural feeling in the life of both the horse and the dog. These diversities

[1] Of details, I have made account in *The Relation of Mind and Brain*, chap. vii.

make an additional demand upon caution in applying tests. At this point, some advantage to scientific induction arises from Darwin having allowed himself to extend observation beyond the higher mammals. A wide range of sympathetic feeling is thus included, but under this division of evidence, marks of intelligence are less prominent. He says: 'With those animals which live permanently in a body, the social instincts are ever present and persistent. Such animals are always ready to utter the danger signal, to defend the community, and to give aid to their fellows in accordance with their habits; they feel at all times, without the stimulus of any special passion or desire, some degree of love and sympathy for them; they are unhappy if long separated from them, and always happy to be again in their company. So it is with ourselves.'[1] The accuracy of this account will be at once admitted, presenting important phases of experience common to animal and man. What are included under gregariousness are phases of animal susceptibility. The gregarious is more prominent than the social, and the social feeling is more prominent than action of intelligence. Laying aside instincts, not claimed as evidence of intelligence, and applying the distinction between sensible and intelligent discrimination, intellectual phenomena are here few and unimportant. The agreeableness experienced from the presence of numbers, is a phase of sensibility which must be referred to organism. There seems no ground to conclude that this depends on intelligent discrimination, any more than on special passion.

[1] *The Descent of Man*, p. 112.

Nor does it appear that we can otherwise classify the danger signal, any more than the passionate defence, in case of attack. Here we are still contemplating phenomena of animal life. Uniform association with the species, leads to uneasiness in separation. The absence of intelligent discrimination is particularly marked here. There are few phenomena for which it seems possible to claim an intelligent origin, or even as much as can with certainty be described as intelligent direction. All the characteristic features of the social life of man are wanting in the life of animals most gregarious; while all the animal characteristics appear down the scale, greatly below the higher mammals. Some of the insects 'are social, and aid one another in many important ways;'[1] 'rabbits stamp loudly on the ground with their hind feet as a signal;' 'animals of many kinds are social, we find even distinct species living together; for example, some American monkeys, and united flocks of rooks, jackdaws, and starlings.'[2] We do not suppose that any one claims that these facts warrant an inference to intelligence. Facts more obviously approximating towards those of human life are not conspicuous among animals the most gregarious. As to this, Darwin bears important testimony, showing how much is the product of impulse, how little of intelligent direction. A general and careful survey of animal life has led him to the conclusion that, 'there is no evidence that any animal performs an action for the exclusive good of another species.'[3] Accordingly the law of natural selection does not point to advance

[1] *The Descent of Man*, p. 100. [2] *Ibid.*
[3] *Origin of Species*, p. 194.

by way of intelligence. 'Natural selection acts only by slight modifications of structure or instinct, each profitable to the individual under its conditions of life.'[1] The absence of reference to intelligence is marked here. 'Survival of the fittest,' taken as the expression of each successive stage in the history of evolution, involves organic modification of the social impulse. Under natural selection, which is one of the surest inductions of this age, the argument for continuity of organic evolution depends on the reign of passion in animal life, consequently implying that intelligence has not supplied the law of progress in the natural history of the earth. If, therefore, it be true, as it obviously is, that under the law of natural selection there has been continuity up the whole scale of organic life, it follows that, as we do not on this line find warrant for severance of lower orders from higher, the classification of the higher mammals as intelligent must rest on some other basis than is supplied in the history of the common struggle for existence. That struggle has uniformly shown the power of passion, standing in contrast with intelligence.

We have now reached a point where it is needful to bring man into contrast with animals low in the scale. Here we must make room for development of the difference between Instinct and Intelligence. This will prepare for more exact conclusions as to the relations of animal to human intelligence. Until we have set these two more clearly in antithesis, it is impossible to make way for reliable inductions. 'Instinct' cannot be left as an undefined residuum into which perplexities may be cast—an unexplored

[1] *Origin of Species*, p. 211.

territory where may be a desert or an Eden, but where all is unknown. The contrast between Intelligence and Instinct is in some respects clearly recognised, even though both terms suffer in general usage by lack of exact definition. Biologists would not generally take exception to the statement made by Darwin, that 'the fewness and the comparative simplicity of the instincts in the higher animals are remarkable in contrast with those of the lower animals.'[1] This implies that there is some broad difference commonly recognised, of such importance as to exalt the lower animals when 'instinct is considered, just as we exalt the higher mammals when 'intelligence' is the test. This broad contrast is one of the most helpful things for guidance here. 'Instinct' is our name for some power not yet scientifically explained, determining action, inherent in organic life, and appearing quite low in the scale of animate existence. 'Instinct' stands out clearly as a source of action, distinct, on the one hand, from sensibility, and, on the other, from intelligence. In assigning its proper value to the statement of Darwin just quoted, it seems necessary to admit that 'instinct' makes up so far, in lower orders of life, for lack of intelligence, securing results unattainable by means of the recognised laws of sensibility, results so surprising to us as intelligent observers, that we are at a loss to account for their occurrence. Such instincts are illustrated in the nest-building of birds; in care for the young, as in the insertion of eggs in the heart of a bud which may supply nourishment suitable for the young life,[2] or in the sunning of the pupæ by the common ants of

[1] *The Descent of Man*, p. 67. [2] See page 186.

the British forests; or in the grain-storing of the 'agricultural ant' of Texas. Illustrations are numerous and endlessly varied. The most outstanding feature of all that is named 'instinct' is a marked superiority in procedure to intelligence itself, as well as to common sensori-motor activity. Under 'instinct' we include a multitude of actions to which this rule clearly applies. Animal conduct, unattainable by us, even by use of our intelligence, cannot be referred to intelligent power. How natural the remark of Agassiz: 'No one will deny that the honey-comb is constructed with more art and care than the huts of many tribes of men.'[1] Yet we include under 'instinct' many actions much more remarkable than the building of comb. Within its own sphere, superiority must be granted to intelligence, yet potentiality of instinct is one of the secrets of lower organism. So much did Darwin recognise perplexity in this feature of lower organic life, that he opens his chapter on 'Instinct' with these words:—'Many instincts are so wonderful that their development will probably appear to the reader a difficulty sufficient to overthrow my whole theory.'[2] Such a result is not to be apprehended. The general lines of evidence for evolution, appearing up the whole scale of organism, are such that the foundations of the theory are exposed to no serious peril here; but on this very account the perplexities of 'Instinct' are the greater. The possibilities of organism still quite baffle scientific inquiry, and 'instinct' is one of the most startling illustrations of these possibilities, deserving to be placed alongside

[1] *Outlines of Comparative Physiology*, § 193.
[2] *Origin of Species*, chap. viii. p. 191.

of the marvels of development of the most differentiated structure from the germ-cell.

Perplexity is increased by mixing up 'mental characteristics' and 'origin of the mental powers' with phenomena illustrative of animal instinct. It is hopeless to attempt construction of a theory of the industrial life exemplified in the bee-hive by supposing that bees know and apply mathematical principles. Just as unpromising is the supposition that ants have taught their children how, in turn, they are to take care of their own young; or that these same insignificant creatures, swarming across the path before your feet, have invented language, forestalling human efforts in this direction. We have remarked the guarded form in which Wallace makes reference to 'the manifestations of intelligence, amounting in some cases to distinct acts of reasoning in many animals.' But no one proposes to account for the astonishing activity of insect life on the supposition that bees and ants reason out their conclusions, as men estimate engineering difficulties, and construct machines to overcome them. Yet the perplexities connected with insect life are such that Darwin is induced to say, 'A little dose of judgment or reason, as Pierre Huber expresses it, often comes into play, even with animals low in the scale of Nature.'[1] Huber is an authority in this department. There is a delightful simplicity in this 'little dose,' applied to a brain like a pin-point in its dimensions; but the playfulness of the remark tells how truly scientific authorities have felt unable here to apply scientific methods. The suggestion is of the *deus ex machina*

[1] *Origin of Species*, p. 191.

type, which science rejects. The 'little dose' must be left to organic chemistry, in a region rather remote from psychology. Evolutionists facing the problem of intelligence in Nature will recognise here the danger to a doctrine of continuity, already pointed out, and will assign due value to the statement of Darwin that 'the fewness and the comparative simplicity of the instincts in the higher animals are remarkable in contrast with those of the lower animals.' In view of the facts, we shall not feel warranted to suppose that the higher mammals have had 'a less dose' of judgment or reason. It must be recognised that 'instinct' is highly characteristic of lower forms of life. Hence, its supposed relationship to intelligence must be held untenable, and we must abandon the attempt to reach 'an accurate notion of the frame of mind under which an instinctive action is performed.'

Closer examination of the phenomena must guide towards a clearer induction. Darwin has well said that, 'an action, which we ourselves require experience to enable us to perform, when performed by an animal, more especially by a very young one, without experience, and when performed by *many* individuals in the same way, without their knowing for what purpose it is performed, is usually said to be instinctive.' This admirably expresses the general aspects of the observations leading to our common references to instinct. Difficulty in tracing the several particulars is admitted in each case; for we are agreed that actions, named instinctive, often show facility in achieving results which we could not reach; or, if the actions are possible to us, they can be done only

after reflection and training. This constitutes our difficulty in explaining 'instinctive' action. Hence it is that an exact definition of 'instinct' is impossible. That which is only partially known to us, and known only in an external way, cannot be exactly defined. On this account, general descriptions, such as that just quoted, must suffice to indicate that we have identified certain phenomena of organic life which are not obviously capable of explanation by reference either to sensibility or to intelligence.

The puzzles of animal instinct are to be attacked from the side of *activity*, leading to inference as to potentiality. We must leave in abeyance, for the present, the question as to the manner of execution. Such reservation of the question is warranted by the admission that instinctive actions are not the result of experience. The single line of approach must be recorded observations of animal conduct. These are exceedingly varied, and are rich in suggestiveness. It is impossible to doubt that a truer conception of Nature is to be reached by more successful interpretation of animal instincts. At the same time our prospects of success are greatly restricted by the fixed conditions of the inquiry. Much more easily and certainly can we advance towards exposition of the action of intelligence itself than of instinct. In many cases, the examples of instinctive action present a most complex set of relations. Only the results are known. How the actions are accomplished, is a question which observational science cannot answer.

Our main dependence must be on classification of facts, such as may warrant inductions. Such classification may most readily be formed by reference to the

ends gained by actions named 'instinctive.' Storage of food, and provision for young, are certainly the most conspicuous of these ends. Physiological conditions are not only essential, but conspicuously prominent. These are phases of sensibility, provided for by specialty of structure; sensory experience special to gregarious life; physiological conditions connected with physical wants; transitory experience belonging to periods of reproductive activity; and care of the young during a brief season of dependence. These are all closely connected with ascertained physiological law. So far as appears, references to 'judgment,' to 'little doses of reason,' and to 'frames of mind,' are unwarranted.

First, we take *food supply*. Here we must separate between competition with rivals, and combined action for storage. The struggle for possession has already been conspicuously in view, supplying evidence for evolution. Combined action for storage is the new feature. And this appears in the history of lower forms of life, not in the life of the higher mammals. This contrast accounts for Darwin's remark that instinctive actions are more numerous and complex in the history of lower organisms than of higher. In study of instinct, we are led beyond the merely gregarious tendency which induces a sheep to bleat piteously when it finds itself severed from the flock. We concentrate on the co-operative tendency, strikingly wanting among sheep and higher mammalia, strikingly present in a hive of bees and in a nest of ants. In the search for food, and in the eating of it when found, as in the carnivora, we see only the direct action of appetite. This is instinctive action in

its simplest form. It is the expression of organic need and impulse, in no sense involving intelligence. It is not dependent upon experience, training, or habit. This appears in the act of sucking, by the young of all mammalia, immediately after birth. These actions are clearly non-intelligent.

When we have passed to the co-operative tendency, we find ourselves in a new field of observation, and at the same time, we are concerned with a much more limited circle of animal life—a circle including lower orders, excluding higher orders. Facts and spheres and ends are all well defined, but observations are more complex and difficult. There is now something largely in advance of the hunger-appetite. 'Instinct' here appears as something in advance of a present organic need, and of the impulse which want awakens. There is co-operation in work; a combined activity, concentrated upon a chosen centre for storage. This involves a veritable organisation of a community, under common impulses. Under these conditions, stores are multiplied, and resistance is offered to intruders who would appropriate what has been gathered. This complex range of activity is restricted to animals quite low in the scale of life. This fact increases our difficulties. The argument for continuity up the whole scale is independent of all this, sustained by a wide induction as to organic structure, as that has undergone modification through struggle for existence and use of the powers at command. But ants and bees get over their difficulties in quite another fashion. Their struggle is that which belongs to co-operation, and combined resistance to attack. This is most conspicuous in insect life, and among

lower mammals, as in the life of the beaver. The laws of organic existence themselves provide for these complex methods of co-operative action. These phases of action do not seem to be the result of 'little doses of judgment and reason.' They come from organic impulse more nearly akin to the simple impulse of appetite; and are executed in absence of reflective exercise.

Next, we include *provision for the young of the species.* The mysteries of embryonic life are great at every point in the scale of animate existence. But when we consider provision for nourishment of the young, the contrast between larvæ and embryonic forms of life is remarkable. Here also complexity of procedure appears most striking in insect life. In the case of the higher mammals there is, in the temporary dependence of offspring, under physiological provision for lactation, an almost bald simplicity, in contrast with the complex arrangements of insect life. These far surpass, in their provisions for the coming life, all that is accomplished by the knowledge and foresight of man. Most striking illustrations are stored in the annals of natural history. I take a single example as given by Weismann, when referring to the way in which the *Cynipidæ* (*Rhodites rosæ*) deposit their eggs in the tissue of a young bud. The action of the mother is thus described; 'she first carefully examines the bud on all sides, and feels it with her legs and antennæ. Then she slowly inserts her long ovipositor between the closely rolled leaves of the bud; but, if it does not reach exactly the right spot, she will withdraw and reinsert it many times, until at length when the proper place has been found, she will slowly bore

deep into the very centre of the bud, so that the eggs will reach the exact spot, and here the necessary conditions for its development alone exist.'[1] This is one of the most striking examples which can be selected in illustration of the provision made by insects for development of their young. Judged by the analogies of human conduct, we should regard it as an example of provision and forethought; but the insect's conduct is independent of experience, the skill and care being manifested only when maturity prepares for functions of reproduction. The activity is as clearly distinct from intelligent action, as it is from mechanical. The young mother provides for activity of the larvæ just as if its conditions were foreknown. When we attribute her action to 'instinct,' we mean that it cannot be accounted for by appetite, such as hunger which impels her to appropriate food for her own want. Her feeling and action, in this case, belong exclusively to the state of maturity, being incidental to the period when her eggs are to be deposited. Under a powerful impulse characteristic of her state, involving special and periodic phases of sensibility, involving inducement towards activity in a single direction, she acts as if intelligence and purpose were present, accomplishing what intelligence could not achieve. Impelled by a physiological condition, and guided by a special sensibility towards a single line of action, she ascertains what is unattainable by man. In the economy of Nature, the life of a succeeding generation is secured in ample food supplies,

[1] Weismann's *Essays on Heredity*, p. 93; 2d ed. vol. i. p. 94. For additional examples, see Mivart's *Essays*, ii. p. 405; and Romanes's *Darwin and after Darwin*, p. 293.

when she can have no part in tending the young life. Results depend partly on development of the bud, partly on the functions of the organic germ. As it is impossible to account for the action of the mother by reference to 'mechanical arrangements of particles in the germ,' or by 'conditions of tension and movement' in the organism of the mature insect, or by mere 'shock and impact' consequent on her alighting on the bud, though all these things are certainly included; so it is impossible to explain the procedure of the insect by past experience or by processes of reasoning. There is nothing of the inferential, as there is nothing of watchfulness over the young life, such as is witnessed in the case of the mother bird. The organic impulse, is certainly more akin to appetite than to rational procedure, for there is extreme sensibility, acted upon by the state of the bud. These conditions secure exact adaptation of means to ends, and to ends unknown to the worker. Structural adaptations to functions of the life seem invariably recognised in the action of 'instinct,' just as in the simpler actions of our own life, such as the winking of the eyes, shrinking from pain, changing of posture when uneasy. Structure and instinct are correlated. Darwin is obviously correct when he says 'instincts certainly do vary,' and variations are due to change in feeling consequent on change of environment.

This whole range of observations as to animal instinct, and the speculations following, have been seriously entangled and perplexed by introduction of the analogies of intelligent procedure. Until we have separated instinct from intelligence, no trustworthy advance can be made towards a scientific explanation

of instinctive action in animal life. There has been care enough to restrict the significance of instinct whenever an approach has been made to exact definition; but there has also been unquestioning use of the whole phraseology applicable to rational action, just as if no such definition had been reached. There is general agreement with Darwin's account of the essentials of instinctive action: 'An action, which we ourselves require experience to enable us to perform, when performed by an animal, more especially by a very young one, without experience, and when performed by many individuals in the same way, without their knowing for what purpose it is performed, is usually said to be instinctive.'[1] Some of these characteristics may, as Darwin says, be wanting in certain cases, sufficient to allow for variation in instinctive action, such as certainly occurs. Biologists are, however, agreed that instinctive actions are done 'without experience,' and without knowledge of the purpose for which they are done; yet so uniformly as to be included within the conditions providing for continuance of the species. What is required of us is, consistency with the admission that the action is done 'without experience,' and 'without knowledge of the purpose' for which it is performed. There is a surrender of such consistency, when instinct is classified with 'the other mental faculties in animals of the same class,'[2] and when it is said 'that several distinct mental actions are commonly embraced by this term,'[3] and that variations in instinct imply variation in 'the mental qualities of animals of the

[1] *Origin of Species*, chap. viii. p. 191.
[2] *Ibid.* p. 191. [3] *Ibid.*

same kind, born in a state of nature.'[1] If experience, and purpose, and knowledge of the relation of means to ends, are to be taken as functions characteristic of mind, it follows that actions from which all these are absent cannot be attributed to mental power. This is the ground on which actions are referred to instinct, and to this view there must be rigid adherence if we are to have scientific exactness. There is little hope of reliable advance in the inquiry as to animal intelligence, if it be not recognised that Instinct stands in contrast with Intellect.[2] The entire chapter on Instinct in Darwin's *Origin of Species* must be read in altered form, consequent upon deletion of the references to 'mental faculties.' After this has been done, the facts remain available, as before. They are data on which fresh induction may proceed; but theoretic interpretations, held to be tributary to a scheme of the evolution of animal intelligence, are to be discarded. Acquisition of knowledge is not within the province of instinct. No one speaks of 'instinctive knowledge.' Examples of 'instinct' invariably present phases of action: and the actions recorded are such as are not explained by practice, by acquisition of knowledge, or by subjection to training. It is the

[1] *Origin of Species*, p. 195.

[2] How much of uncertainty as to the method of treatment clings to all our discussions regarding Instinct may be seen by reference to the discussions of biologists and of psychologists. Compare the following:—Darwin's *Origin of Species*, ch. viii., Wallace's *Darwinism*, p. 441. Weismann's *Essays on Heredity*, with reference to 'reflex mechanisms.' Romanes's *Animal Intelligence*, pp. 10-17, and *Mental Evolution in Animals*, chaps. xi. and xii. Lloyd Morgan's *Animal Life and Intelligence*, p. 422. Herbert Spencer's *Psychology*, Part iv. chap. v. Sully's *Psychology*, p. 481. James's *Text-Book of Psychology*, ch. xxv.

absence of knowledge which is the source of astonishment to us. We are baffled, when insects are adepts. From our account of Instinct and of Intellect, it is clear that each is excluded from the field of exercise belonging to the other. The one has an area of activity, the other a sphere of knowledge. From this it follows that all inductions are faulty which assume Instinct to be a stage in the history of evolution of Intelligence. In thus relegating instinct and intelligence to distinct spheres, there is nothing adverse to the acknowledgment that instinct may appear in the life of the higher mammals, and even in the life of man. The general conclusion now reached as to their contrast is, however, sustained by the 'fewness and the comparative simplicity of the instincts in the higher animals,' in contrast with those of animals low in the scale of life.

At this point, much that has hitherto been held to belong to the argument for evolution is seen to fall away. Continuity of organic evolution of the whole scale of life is maintained on distinct lines of evidence, and the theory is liberated from the perplexity occasioned by an apparent breach of continuity consequent on attributing intelligence of a special order appearing so low as insect life. In accordance with Darwin's suggestion, we again pass up to the higher mammalia for evidence of intelligence. If this higher power here appear only in minor form, quite inferior to human intelligence, yet is the 'animal intelligence' closely allied with the human, being clearly in advance of all that appears in the life of lower animals. The wonders of instinct stand unexplained. They are referred to animal sensibility, not

to intelligence. In their highest phases, they belong to forms of life possessing organs of touch quite special in their sensitiveness. So far as continuance of the species depends on these wonders of instinct, dependence of the larvæ is much greater on external conditions, apart from the mother's care, than is the case in the life of the young of the higher mammals.

A problem is here left outstanding for the evolutionist, which is still of sufficient difficulty to make us readily appreciate the opening statement of Darwin in his chapter on this subject:—'Many instincts are so wonderful that their development will probably appear to the reader a difficulty sufficient to overthrow my whole theory.' The difficulty may seem less puzzling when the problem is more completely freed from the entanglements which have been allowed to gather around it, specially when it is seen that the argument as to animal intelligence must be dealt with on data entirely apart. On the other hand, how much of the evidence relied on as favouring evolution of intelligence must disappear on the same account, may be judged by reference to a single example. Darwin reasons thus as to the intelligence of apes:—'The anthropomorphous apes, guided probably by instinct, build for themselves temporary platforms; but, as many instincts are largely controlled by reason, the simpler ones, such as this of building a platform, might readily pass into a voluntary and conscious act.'[1] The building of a temporary platform connecting the branches of a tree, so constructing a resting-place for the night, does not stand high as an

[1] *Descent of Man*, p. 82.

example of the many wonderful instincts. It may possibly illustrate rather the primary aspects of appreciation of the relation of means to ends, and may be assigned to position as a phase of knowledge. I regard this as the more probable view. But whether we assign it to instinct or to knowledge, the subsequent argument fails to contribute anything towards the conclusion accepted. Reason's control of instinct in our own life does not illustrate instinct. Such control implies pre-existence of reason; the conscious and voluntary determination is antecedent, and manifests superiority of power.

Now at length, after careful survey of lower levels, we advance towards the height, on which the grand problems of intelligence become visible. Study of comparative intelligence now becomes possible. In the life of higher mammals, with simpler instincts, we find evidence of a measure of intelligence, bringing them into closer relations with humanity than is possible for any other order of life. Intelligent discrimination is distinguished from the highest susceptibility belonging to sensory apparatus, whether characteristic of the general nervous system, or concentrated in special structure, as in the antennæ of insects.

The problem of Animal Intelligence is one of considerable complexity on account of diversity of animal structure, and variety in the conditions of life. A group which includes the dog, horse, monkey, and ape, shows this in a striking way. In structure, the monkey and ape approximate to man in a degree unapproached by the dog and horse. The animals are further severed in respect of apparatus for the special

senses. The dog and horse are far behind the other two in the sense of touch, far in advance of them in the sense of smell. Structural differences tell largely on the phases of evidence for Intelligence presented by the several lives. Differences are further multiplied, when account is made of relations to environment; for amongst these are great contrasts in range of experience, and measure of contact with human influence. The conditions of their life have associated the dog and horse with man; in the case of the monkey and ape, these conditions have separated the animals from man. Such marked differences must have important bearings on the lines of evidence available as to comparative intelligence. Monkeys and apes may build platforms up the trees; dogs and horses will find a bed on easier conditions, having no occasion for use of intelligence in this matter. Companionship with man has played a large part with the domesticated animals, involving special advantages for development of intelligence. A wild, restless life, excited by approach of man, and suspicious as to his doings, speaks to a measure of separation which has no analogy in the history of domesticated animals. These contrasts must be allowed due consideration. The animals nearest to man in configuration have been most removed from his influence; those less like him in configuration have had most advantage from his guidance. It will, therefore, seem altogether natural, if the dog and horse supply clearer evidence of intelligence. Such acquired superiority will not warrant our assigning to domesticated animals a natural superiority. Evidence as to faculty must be estimated by strict intellectual test, applicable equally to all

the four animals. This test must be evidence of an intelligent discrimination, distinct from sensible discrimination. Evidence of intelligence will most readily be found in two directions, adaptation of means to ends in actions natural to the animal, and interpretation of signs for guidance of action. We have thus a general test which can be applied to the whole range of observations concerned with the natural life of animals; and a special test when domestication has placed an animal in constant and close companionship with man. We place first the test of natural activity under pressure of natural demands. We shall take next the educational test, when man takes direction of an animal. In the one case, we ascertain what powers appear when the animal is left to itself; in the other, we judge of a capability for development which would not have been called forth in meeting the common wants of animal life.

Taking first the *natural life* of the higher mammals, the range of evidence is not at all so wide and varied as that drawn from domestication. This is so far accounted for by the fact, that observations of animals in the natural or wild state, being much more difficult and less frequent, must yield restricted and more precarious results. By way of balancing this deficiency, it must be remembered that domestication only sets more vividly in view the power natural to an animal. We do not originate the characteristics of species. At best, we can only develop them by supplying such external aids as superior intelligence may bring within reach. Hence the extent to which an animal can understand our purpose, and render to us aid in work, is a sure test of natural intelligence, allowance

being made for effects of training in the history of the species. If acquired variations in structure and function have greatly contributed towards the unfolding of life on the earth, we may anticipate that the results of domestication will considerably modify our conclusions. Activity in their natural state must, however, present the full measure of efficiency in evolution by natural selection. Development of intelligence by intervention of higher intellectual power requires to be deducted, as belonging to a later epoch in natural history.

When the higher mammals are compared with the lower, it is clear that a power of Intelligence must be attributed to the higher, which cannot be credited to the lower. Phenomena of domestication come to our aid here, confirming the generalisation. These lead us to distinguish between our pets, and our helps, among the animals. We do not gather so much towards proof of intelligence from our observations of pigeons and rabbits, as from the activity easily within compass of the dog and the horse. Additional vividness is lent to the elevation of the higher mammals in the scale of life, when the dog, highest in manifestation of Intelligence, is placed in contrast with the ant, highest in Instinct. Apart from knowledge and intelligent purpose, the ant goes far in advance of the dog when acting according to its own life-impulses. By use of intelligent discrimination apart from instinct, the dog goes far beyond the ant, and excels all intermediate life. The ends of Instinct common to both animals may be classified under food and shelter. In these we contemplate ends common to life. Thus reliable comparison may proceed according to difference

of method for attaining these ends. Further, in order that evidence may be carefully examined, it is needful to narrow observation to the facts of individual life, without reference to the struggle for existence, and the play of passion, unfavourable to manifestation of intelligence in man or in beast. When this is done, it becomes clear that the ant is restricted in action by the limits of instinct, whereas the dog advances beyond this limit, making acquisitions under training. A physical basis for this contrast is readily found, by reference to the range of sensibility at the command of each life. The whole contrast does not, however, seem accounted for in this way. An animal with such range of vision as the dog possesses, has many advantages. Guided by touch, quite marvellous in delicacy, the ant nevertheless encounters many limitations which do not restrict the animal guided by sight. Thus, the consequences to the ant from injury or loss of the antennæ are serious. Dr. Romanes has described the result in the following terms:—'Their removal produces an extraordinary disturbance in the intelligence of the animal. An ant so mutilated can no longer find its way or recognise its companions. . . . It is also unable to find food, ceases to engage in any labour, and loses all its regard for larvæ, remaining permanently quiet and al most motionless.' Place in contrast with this animal a blind dog, and in contrast with both a blind man. By differences in result, we can infer differences in the measure and kind of power at command. This test will prove still more exact, if we imagine the dog deprived of the power of smell, the organ in which he is pre-eminent, while retaining sense of sight. The

[1] *Animal Intelligence*, p. 142.

value of differentiation in physical basis for sensible discrimination is clearly illustrated in the condition of the dog. But this is not all. There also appears evidence for possession of Intelligence. We can still speak to the dog, and observe in him powers of discrimination impossible to the lower mammals. For him, companionship with his master counts for much. The difference here becomes apparent when we consider what a word is to a dog; for example, the bare utterance of his name, in comparison with what a word counts for in the hearing of a rabbit, or in affecting the activity of an ant. Place in contrast with all these animals, the case of the man deprived of sight and of hearing at one stroke, and it will be seen in what respects life is according to Intelligence.

When now we return to consider the inaction of the ant deprived of the antennæ, nothing is clearer than the need to modify the reference to 'disturbance in the intelligence of the animal.' What here seems most conspicuous is the lack of intelligence, over against the marvellous power of sensibility. When we turn to observe the consequences in the life of a man, following on permanent injury to the nerves of vision, the painful restriction on his relations to the external world has over against it, exercise of intellectual power, rendered more conspicuous. We are at once arrested by the abiding interests of such a life. We even receive special lessons, impressive and inspiring, as to our common work of self-government, from the life of a Milton or of a Fawcett.

Evidence for animal intelligence becomes still clearer when we turn to observations connected with the history of *domestication*. Though the results

thus obtained cannot be regarded as belonging to the natural history of evolution, they are of the highest value as bearing on possession of Intelligence. Our observations now become closer, more constant, and more exact. We ascertain the capabilities of animals when, in companionship with man, they are aided in development of intelligence by his guidance and training, even by sharing in his work. There is thus large gain in passing from natural conditions to artificial. In classifying together the dog and horse, the monkey and ape, we are, so far, treating analogies of structure as secondary, in order that observation may be concentrated more directly on manifestations of intelligence. Each species named gives evidence of a power of discrimination superior to sensibility. Ability to interpret sensory experience appears in their recognition of some meaning in the word uttered by us. This supplies distinct evidence of Intelligence, provided that the word employed be something more than the reproduction of a sound for food or drink, used by the animal itself even in its natural state. Sounds natural to animals as expressive of hunger, or as indicative of pleasure when food is within sight, afford no testimony for intelligence. What we need is some evidence of advance beyond sensibility, and beyond utterance of the inarticulate sounds which belong to all animals above the fishes.

In dealing with comparative intelligence, we may have to allow to the dog superiority over the ape, so little does analogy, or even homology, of structure seem to guide in applying tests of intelligence. On the other hand, passing from configuration of body to structure of brain, the form of this organ may differ

greatly, as appears when the brain of the dog is compared with the brain of the ape.[1] Yet their functions are nearly identical, excepting provision for diverse sensory apparatus. The search for evidence of intelligence leads us to put out of account differences of form in the central organ, and to deal largely with interpretation of signs, quite apart from specialties in outward forms of action. Here, signs of intelligence in the dog prove even more impressive, because of the fact that the bodily structure of the animal renders imitation of the forms of human action almost impossible. Some considerable allowance must be made for this, if we are to be exact in our conclusions. On the other hand, when comparison here seems greatly to the disadvantage of the monkey and ape, full value must be assigned to the long period of the dog's companionship with man, which has left a deep imprint on the species.

Human agency and animal co-operation are now to be considered in their possible relations to each other, mainly for the purpose of ascertaining when interchange of understanding occurs, and to what extent. This method of inquiry is determined by the history of life on the earth, since co-operation and domestication of animals have been settled by natural affinities. The intellectual test warrants us in classifying the higher mammals as we do. This appears when we contrast these animals with others lower in the scale. The lower the animal, the more difficult it is for us to direct its activity, so as to secure co-operation in our work. This is a testimony adverse to the inference

[1] I have given the illustrations in *The Relations of Mind and Brain*, p. 99, and p. 154.

of intelligence, low in the scale, except in so far as allowance is to be made for difficulty in communicating with such animals. On the other hand, 'instinct,' even such as to awaken our astonishment, offers no possible aid in our actions. The ant and the bee, wonderful in instinct, cannot co-operate with us. By means of our intelligence, recognising adaptation of means to their ends, we can co-operate with them, in their efforts, guided as they are by instinct alone. Co-operation with man depends upon a measure of intelligence in animals equal to interpretation of his signs for guidance. In the higher mammalia, structure and intelligence combine in presenting the conditions on which man depends for help in his own work. In co-operation with man, the dog can do what the ant cannot do. This implies first a physical difference. The work done is the result of higher structure and of muscular development in the dog. It shows besides, the action of intelligence. On the other hand, the ant can do what neither the dog nor man can do, and this because of specialty of structure and of 'instinct.' To Instinct, we refer possibilities of sensibility and of reflex activity, such as do not appear in the life of the dog. In this respect, the ant is distinctly superior to the dog, though to the latter we assign intelligence. This contrast harmonises with the conclusion already reached, that Instinct is not guided by Intelligence nor does it contribute towards evolution of Intelligence. The two functions stand quite apart.

When these differences are fully considered, it will be found possible to clear away entanglements caused by mixing together phenomena of Instinct, and those of Intelligence. In the same way, it will become

clear that there is no explanation of instinct by reference to reflex action alone. And no less obvious will it seem, that no explanation of instinct is to be had by describing it as 'memory' of past achievements in the history of the species. The key is to be found within the organism of each individual worker. It is a matter of structure, and belongs to sensory apparatus.

A striking light is thrown across the relations of human intelligence to animal activity, when we consider the conditions of our interference with the activity of insect life, in contrast with our guidance of the activity of the higher mammals. We can rationally co-operate with the insects in the carrying out of *their own* work; the higher mammals intelligently co-operate with us in the doing of *our* work. In the one case the understanding comes altogether from man. We understand what the insects are doing, and we bring our appliances to their aid. In the other case, some measure of intelligence belongs to the animal as well as to man. This difference is strikingly illustrated in the management of bees, when aid is rendered them in the building of their comb, so as to secure increase of honey. By use of thin plates of impressed wax, a beginning can be made for a honeycomb which the workers accept as work already done, and from which they will proceed, as they begin to bring in their stores.[1] This is the method by which small squares of honey are secured for placing on the table. Though we cannot aid in the honey gathering, the bees accept the aid proffered in their task of storing, thus carrying forward their task more quickly,

[1] Cheshire's *Bees and Beekeeping*, Scientific and Practical, 2 vols. See vol. ii. p. 182.

as if the preliminary work had been done by themselves. Closer observation of bees when engaged in their work suggests that what we have hitherto taken as 'instinct' in building the cell, is a result rather of the structure and functions of the body. The wax is secreted by a gland under the plates laid over each other behind the wings. With this, is connected a series of very fine fibres or hairs, longer at the centre, shortened towards the sides.[1] When structure, function, and results are compared, it seems that the form of the cell arises from the form and range of mechanical appliances belonging to the worker.

The almost mechanical exactness in the action of insects becomes exceedingly suggestive. P. Huber gives a striking illustration in the life of a caterpillar which makes a very complicated hammock. These observations have been summarised by Darwin.[2] 'If he took a caterpillar which had completed its hammock up to, say, the sixth stage of construction, and put it into a hammock completed up only to the third stage, the caterpillar simply re-performed the fourth, fifth, and sixth stages of construction. If, however, a caterpillar were taken out of a hammock made up, for instance, to the third stage, and were put into one finished up to the sixth stage, so that much of its work was already done for it, far from deriving any benefit from this, it was much embarrassed, and in order to complete its hammock, seemed forced to start from the third stage, where it had left off, and thus tried to complete the already finished work.' It thus seems that functional action and sensory ex-

[1] Cheshire's *Bees and Beekeeping*, vol. i. p. 153.

[2] *Origin of Species*, p. 192.

perience combine in determining the insect to work. The difference, in the case of the bees, suggests that the help given by artificial supplies of wax, co-operates so as to favour activity in the main function of honey-gathering and storing. The wax is produced from the saccharine matter collected, thus being really a part in a single course of activity.

In the field of instinctive action, we can but co-operate along the lines of an almost mechanical process. Our intervention is helpful only in cases in which, notwithstanding proffered aid, the worker has additional toil by which its energies are engrossed. We understand and experiment; the insects work only under sensory impulse. This supplies contrast to our observations on the co-operation *with us*, by the higher mammals. At best, human intelligence can do no more than aid the insects in their own work. We have no evidence of understanding on their part. As I stood lately by a bee-farmer, in the midst of long ranges of hives, watching the coming and going, I remarked incidentally on his working among the bees with impunity. His reply was,—'At one time, I thought they knew me; but I find it is only I that know them, for I can work as readily amongst another man's bees, as amongst my own.'

If from the sphere of instinct, so wonderful in lower orders, we pass to that of intelligence, the contrast confirms us in the marking out of its distinctive characteristics. The dog not only co-operates with his master as a helper in human work, but his knowledge of his master and of his master's mode of expressing his purpose, belongs to the essential conditions of his activity. The life of the household dog supplies

constant illustration; the daily work of the 'sheep-dog' affords still more valuable evidence. The delightful stories given by Dr. John Brown, from *Rab and his Friends* onwards, supply testimony in most attractive form. The dog so understands, and so acts on the understanding, as to become the efficient helper of man. Practical tests are most valuable here. The results thus obtained greatly exceed in worth, as a test of the dog's intelligence, all results gathered from use of written signs, and refusal of food-supply, until the proper card for 'food' had been selected and delivered. If true value be given to the evidence proving the dog's dependence on his own master, we shall see at once the contrast between instinct and intelligence, and testimony to the limits of 'animal intelligence.' The interpretation of signs is undoubted; the animal's action depends on constant use of quite familiar signs. Reflectiveness is however entirely wanting. We are without proof of any such expansiveness of intelligence, or self-educating power, as appears in every child. How to explain these differences may be a sufficiently perplexing problem; but as the contrast between instinct and intelligence has been quite broadly marked, so also now is the contrast made clear between animal intelligence and man's acquisition of truth.

The value of the evidence for animal intelligence depends largely on the training the animal has had. When signs, audible or visible, are employed, aptitude for training must prove a valuable test of the measure of intelligence possessed. The animal capable of this, transcends the sphere of sensible discrimination, showing itself able to interpret sensory experience, and to apply such interpretation for its own guidance.

The highest instinct supplies no such qualification; wherever this capability appears, the evidence for intelligence is conclusive. In our application, however, of the 'educational test,' the variety of conditions, under which training can be carried on, needs to be carefully considered. Diversities of structure, of temper, and of relations to environment in the free life of the animal, combine to modify the possibilities of training members of the several species. Regard to animal sensibility is a constant necessity for successful training, whatever the species. Only in this way can the conditions be maintained which favour the action of intelligence. There is in this, a test for the trainer as well as for the animal. When the restlessness of the monkey is considered, along with his natural suspicion, his susceptibility to fear, and his destructiveness, it is obvious that a much greater amount of patience, care, and continued gratification of his natural inclinations, will be required to show the intelligence he possesses, than can be needful in the case of the dog. Mr. Garner's experiments with monkeys supply striking testimony here. When from the phonograph the sound of alarm was given, the monkey eating from his hand sprung at once to the utmost perch, and Mr. Garner adds 'no amount of coaxing would induce him to return to me, or to accept any offer of peace which I could make.' So much is undisturbed confidence essential for success in training. This single example shows how complicated the lines of evidence become on which we depend for conclusions as to comparative intelligence. Fear and fondness are the two governing forces in animal life. The former must be allayed,

the latter must be used as our auxiliary, if the test of training is to be applied. The man who would govern an animal, must first govern himself.

The results of continued friendly companionship with man supply the most reliable tests of animal intelligence. As the dog has been most favoured in this respect, evidence is most abundant from its life. This evidence is better gathered from its ordinary services to man, in carrying, retrieving, pointing, or driving sheep, than from any attempts at general education. These serve more to prove the relative inferiority of his intelligence, than his natural capabilities. Evidence, at once familiar and reliable, is supplied by interpretation of signs for direction of conduct, such as 'fetch,' 'come to heel,' 'go wide,' and 'go home;' and many more, familiar to the collie. It is better to give less heed to restraints upon action, and more to full activity of natural powers. We must, therefore, first find the basis of our observations in the ordinary life of the animal, and afterwards seek expansion of this by reference to domestication. By power of scent, the dog traces his master in the crowd; intelligence performs no part here. The same dog hears his name called by his master, and is at once arrested. Susceptibility performs here also a necessary part, but there is an association of the sound with past experience to such an extent as to involve a higher phase of discrimination. When the animal is at first arrested, this may be a purely sensible result, the impression being more acute on account of development of sensibility by exercise; but when the call or command of the master is translated into action, it is impossible to

account for what has happened without granting that the sign has been interpreted. This conclusion is confirmed by reference to multiplication of signs for direction of the same line of conduct. A whistle may arrest a dog, but a sign, visible or audible, will direct his action. Our conclusion is further sustained by reference to the significance of sound as determined by the usage of the master. 'Go home,' will send one dog back, but the Gaelic equivalent alone will be effective in the case of a dog reared in the Highlands of Scotland where the Celtic tongue is in common use. Observation affords ample testimony for this. If we decide on the lines of action to be followed, keeping by uniform signs for direction, the higher animals are capable of interpreting signs, readily attaining fixed associations, and performing the work required.

Beyond this, habit may accomplish much. Under this law, action may sink into mechanical routine, just as happens with ourselves. But if intelligence is to be used so as to secure development of the faculty, the whole interest of animal life must be gathered around what is being accomplished. For this, the direct living relation of man and animal must be sustained from day to day,—the man giving actual guidance, and the animal feeling that he has some share in the satisfaction following. We can no more reduce an animal to a working machine, and yet secure development of his intelligence, than we can thus secure intellectual advance in the life of a man. Jog-trot in harness accomplishes little for the horse, however much it does for the owner. The load of stones may arrive at the proper destination, but

horse-power is the efficient agent, since everything requiring understanding has been done apart from the animal. For true development, as for the animal's best effort at the moment, all favouring susceptibilities must co-operate. A timid rider makes the best horse lose the prize. A stranger cannot get the animal to do what his daily guide enables him readily to accomplish. The man who speaks to his horse in familiar accents, who strokes him with an understanding hand, who makes him feel that something extra is to be done; and who has leisure, and care, and living sympathy enough, to make him afterwards feel that he has done his best, will not only get most out of the animal for the time, but will do much toward his development. The prize card fastened to his bridle does nothing for the animal; the man who leads him from the course can do everything.

The docility of the dog and of the horse has done much to aid us in our attempts to estimate their intelligence. The lack of this quality proves a serious hindrance to experiments with monkeys and apes. Mr. Garner has done more service by his own patient efforts to soothe and guide the monkey, than by his experiments in the use of established signs of communication common to the species. If we attempt to construct a record of animal sounds, serving as signs to others, we must include the danger signals of animals far down the scale. Besides, such signal sounds carry evidence of no more than nerve susceptibility in their utterance, and in their effects. This is shown by the general commotion among barn-door fowls consequent on the appearance of a hawk, or of any animal resembling a hawk, far overhead. Very different, however,

is the significance of sound and sign, in cases where co-operation with man proves possible. Mr. Garner has supplied admirable testimony in his records of his dealings with monkeys. I quote here an example which seems conclusive on the leading questions involved in claiming intelligence for the higher mammals. 'One of the most intelligent of all the brown Capuchins that I have ever seen was Nellie, who belonged to a dealer in Washington. When she arrived there, I was invited to call and see her. I introduced myself in my usual way, by giving her the sound for food, to which she promptly replied. She was rather informal, and we were soon engaged in a chat on that subject, the one above all others that would interest a monkey. On my second visit, she was like an old acquaintance, we had a fine time. On my third visit, she allowed me to put my hands into her cage, and handle her with impunity. On my next visit, I took her out of the cage, and we had a real romp. This continued for some days, during which time she would answer me on all occasions when I used the word for food or drink. She had grown quite fond of me, and always recognised me as I entered the door. About this time, there came to Washington a little girl who was deaf, dumb, and blind; she was accompanied by her teacher, who acted as interpreter. One of the greatest desires of this little girl's life was to see a live monkey—that is, to see it with her fingers. The dealer who owned the monkey sent for me to come down to her, as I could handle the monkey for her. I took Nellie from the cage, and when any one except myself would put hands upon her, she would growl, and scold, and

show her temper; and when the little blind girl first attempted to put her hands on her, Nellie did not like it at all. I stroked the child's hair and cheeks with my own hand first, and then with Nellie's; she looked up at me in an inquiring manner, and uttered one of those soft, flute-like sounds a few times, and then began to pull at the cheeks and ears of the child. Within a few moments they were like old friends and playmates, and for nearly an hour they afforded each other great pleasure, at the end of which time they separated with reluctance. The little Simian acted as if she was conscious of the sad affliction of the child, but seemed at perfect ease with her, although she would decline the tenderest approach of others. She would look at the child's eyes, which were not disfigured, but lacked expression, and then look up to me as if to indicate that she was aware that the child was blind.'[1]

This touching story may well stand as a typical case, supplying evidence of intelligence manifested by monkeys, and also by apes, in co-operation with man and under influence of his training.[2] The difficulties of training the monkey are many, caused largely by its restlessness of disposition, along with the heritage which comes to it from ages of wild life. In all such cases, large value must be assigned to the law of heredity. Under this law, the disadvantages for wild animals have been many, as advantages in the history of the domesticated animals have been great, and cumulative in effect. If, however, we consider such

[1] *The Speech of Monkeys*, by R. L. Garner, p. 83.

[2] As to Intelligence of the Ape, see *Relations of Mind and Brain*, p. 252.

an example as that now given, the evidence of the power of interpreting signs seems conclusive. Underneath the temper, petulance, and jealousy, throwing many obstacles in the way, there is a measure of intelligent discrimination, surpassing the familiar functions of the nerve-system providing for sensibility, and for co-ordination with muscular power. That intelligence is to be attributed to the higher mammals, is a conclusion sustained on ample evidence. How wide this classification of animals should be, may involve serious perplexity for a considerable time to come. The difficulties encountered in the attempts to train animals much lower in the scale, are such as to cast doubt over their claim to intelligence. If however we limit 'intelligence' to simple understanding of sensible signs, and refer to the results of training as our ultimate test, it seems plain that there is a degree of truth in the position of Darwin 'that there is no fundamental difference between man and the higher mammals in their mental faculties.' This much seems certain, that there is a common basis of intelligence by means of which man can communicate with the higher mammals. This makes it possible for him to have some measure of companionship with these animals, and to train them to understand and to execute his designs.

Any claim for community of intellectual life, in a higher sense, seems discredited by the evidence. Whenever we pass beyond the interpretation of signs, to look for independent action of a rational power, the search becomes fruitless. Only 'negative results' can be reported. The outstanding characteristics of the rational life will appear more definitely when we

come to trace them in outline. But, dealing here with questions of comparative intelligence, it is obvious that we must restrict our definition of 'intelligence' to its simplest phase. Only on this condition do we find common exercise in the life of animals and of men, to be attributed to common power, which we name 'mental power,' or 'intelligence,' in contrast with physical power, appearing in a sensori-motor system common to all organic life. Allowing for the facts on which we conclude that there are in the life of the higher mammals 'manifestations of intelligence, amounting in some cases to distinct acts of reasoning,'[1] these, taken at their highest valuation, are much beneath what we mean by the powers of a rational life. So great is this contrast, that the difference between the brain of the ape, or of the dog, and the human brain, great as it is, is insignificant in comparison with the distance which separates the lives of these animals from the life of the ordinary man, even if uncivilised man be taken as our standard of human capability.

Evidence fails when we look for independent action of Intelligence in animals. We do not find any of them in their natural state rise above interpretation of signs: we do not see in their history accumulation of knowledge for its own sake. In their use of means for attainment of ends naturally desired by them, we do not find them capable of any considerable adaptation, such as would obviate difficulties, still less such as would increase facilities. Even when, after long training, an animal has been brought to render great service by its aptitude, or to perform surprising feats,

[1] Wallace's *Darwinism*, p. 426.

attainment does not become a starting-point for higher effort. Left to itself, the animal relapses to a life which seeks only the satisfaction of animal wants. It does not appear that effort having for its end the attainment of knowledge, belongs to animal life, whether in a state of nature, or under domestication. These limitations of intelligent action, when compared with normal action of a rational life, seem to show that in the contrast between the higher mammals and man, we are contemplating 'mind,' in two distinct types, a lower and a higher. Granting a common basis of intelligence, capable of interpreting sensory experience, including impressions made by visible and audible signs and adding to this the results of co-operation; there remains a difference of power so enormous, as to require that a distinction be drawn between 'intelligence' and 'reason;' between 'animal intelligence,' and 'rational power.' A power concerned only with the relations of interpretation to action, differs widely from a power of reason (distinctively 'rational power'), concerned with the relations of experience to a sphere of knowledge. This difference is such that we are impressed more by marks of contrast than by marks of resemblance. As these two phases of power appear constantly together in our own experience, we can readily distinguish them. We use a lower power, when we act upon a given signal, or at the call of another; and a greatly higher power when, by process of reflection, we seek the satisfaction of our own mind as to the cause of any occurrence, or judge of our interest in imagined lines of procedure, or of our duty within given conditions. Nothing at all recondite is involved in this distinction. Whatever perplexity

animals may encounter in fulfilling our wishes, there is for us no difficulty in distinguishing between observations and reflections. The characteristics of a higher life are found when, passing beyond interpretation of signs for guidance of action, we seek knowledge for the sake of knowledge. It is in this latter sphere we find the gateway to literature, art, science, and philosophy. These names, indicative of the vast region of rational activity into which man passes, are sufficient to warrant the induction that a power is working here, greatly superior to any power seen operating in the higher mammals.

A large body of evidence sustaining this conclusion as to the inferiority of animals, is accessible in the results obtained by their training. Apart from human guidance, animal activity is directed mainly by sensory experience, comparatively little appearing to warrant the conclusion that intelligence is a regulative power. Still less do we find indications that intelligence is an originating power, to which animal progress can be traced. There is nothing in the records of natural history to warrant the conclusion that any of the higher mammals make any marked advance in adaptation of means to ends. Neither is any animal observed to seek knowledge for its own sake. In most cases, when sensory experience is unaffected by contact with an object, interest in it disappears. The 'curiosity' of monkeys awakens some expectation, as if giving promise of inquiry; but, when carefully watched, it comes to an end, just as the application of smell by the dog and horse does, though the time occupied with the object is longer in the case of the monkey, on account of the wider

range of action belonging to vision and manipulation. Smell is direct and prompt; sight and touch combined give more occupation to the animal.[1]

When next we turn to 'Instinct,' we find this much more conspicuous in animals lower in the scale, than intelligence is in the life of the higher mammals. This will appear in the contrast between the ant and the dog. The comparative significance of this fact is enhanced, when due value is assigned to Darwin's observation that the instincts of the higher mammalia are fewer and less complex. If, then, the life of the higher animals were approximately so close to human life as to illustrate a preliminary stage for evolution of rational power, we should have expected to find in these animals intelligence operating more markedly than it does in their natural state, independently of human training. In like manner, we should have expected a beginning of liberation from the dominion of 'natural selection.' Organic advance secured under 'the struggle for existence,' which is entailed by short supplies, operates in Nature quite independently of intelligence. The operation of the law tells on all life as dependent on nutriment. A modification of this law, on appearance of intelligence, is admitted within the terms of the law itself. 'Natural selection acts only by accumulation of slight modifications of structure or instinct, each profitable to the individual under its conditions of life.'[2] Admitting the law, and also variations in structure and in instinct under its action,—

[1] I have examined the evidence in detail in *Relations of Mind and Brain*, 3rd edition, pp. 252-258, and 275-280.

[2] Darwin's *Origin of Species*, p. 211.

both conclusively made out,—it is not shown that the law is capable of effecting such advance, in structure, or in life-action, as intelligence implies. Granting 'some degree of variation in instincts under a state of Nature, and the inheritance of such variations,' as 'indispensable for the action of natural selection,'[1] it does not seem that appearance of Intelligence among the higher mammals is being accounted for. On the evidence of differentiation, it is not possible to argue that variations are on the way to intelligence, or in any sense preparatory for its appearance. Still less can such a claim be made on the ground of 'slight modifications of structure,' occurring under the law of natural selection. It does not seem that any variation of structure, or any advance in function, or any manifestation of instinct, has been discovered, in the history of lower orders of life, which will account for the appearance of animal intelligence. After structural variations have been explained, animal intelligence stands unexplained. It is here, as it seems in testing the evidence, that a limit in the line of evolution appears. A break comes into view at a stage lower than the appearance of 'rational life.'

Variation of Intelligence is as certain as is variation in Instinct, but the one cannot be accounted for under 'natural selection,' as the other can be. Food has affinity with structure; it has only a remote relation to action of intelligence. Even the success of an evolution scheme, gives vividness to this contrast. Intelligence is a phase of life exempt from laws of nutriment. Mind, even closely related as it is with body, is superior to laws of nutriment. Until we have

[1] *Origin of Species*, p. 194.

lifted the life of intelligence aside from the sphere within which laws of nutriment dominate action, we cannot read the terms of the new problem of existence arising from the appearance of intelligence in the world. Those two fields of existence must be distinguished,—the one a sphere within which variations of structure and of instinct are effected according to supplies of nutriment; the other a sphere within which variations of intelligence are effected under the laws of thought and of reflective self-government. Only when this distinction is clearly drawn, do we properly enter upon a scientific treatment of the higher life of intelligence, and of wider problems presented by the variations of such life appearing in nature. Only thus shall we come full in view of the unsolved problem of the appearance of 'reason, which is our noblest and most distinctive feature.'[1]

Let us stand face to face with the phenomena of Intelligence, even on the lowest levels on which these appear; let us bring to a focus all of these which are common to the higher mammals and to man; beyond these, let us set full in view, as far as we may have ability to do it, the rational powers characteristic of the human race. Only then, and thus, do we face the higher problems of Nature. When this is unhesitatingly and persistently done, we may anticipate surer advance towards a truly scientific view of man's place in Nature. If only these distinct fields of observation be well defined, and kept open to view, we shall be able to estimate the value of the vast body of facts belonging to natural history, testifying to intelligence, when we include man in Nature.

[1] Wallace's *Darwinism*, p. 455.

The relations of animal intelligence to human must to some considerable extent prove the guide of biologists and psychologists in prosecution of a common task. If Intelligence is accurately described as discrimination of the significance of sensory experience; and if its product is knowledge, as distinct from muscular activity, interest must concentrate on the conditions under which the functions of intelligence are fulfilled, first, in the life of the higher mammals, and next in the life of man. The first stage of advance, separates the sensori-motor activity, attributed to all organic existence, from the phenomena of intelligence as these appear in the life of the higher mammals. The next brings out in full relief the phenomena of intelligence common to the higher mammals and man. For adequate description of these, we require a terminology not supplied by physiology, since the phenomena themselves have not been traced to distinctive structure, correlated with circumscribed portions of the central organ. For the first time, warrant is found for speaking of 'mental phenomena,' and of 'mind,' as a distinct order of existence in Natue. From this point, a much more exact understanding needs to be reached as to our use of terms, if a well-defined body of evidence is to guide us in judgments concerning 'mental qualities.' It must be shown how 'mental qualities' differ from qualities of structure, and of instinct. We shall thus have fixed the limits within which the term 'mind' is to be employed, ensuring accuracy as we seek to distinguish 'mental qualities,' and 'mental functions.' Afterwards, we shall pass on towards the 'rational life,' the highest phase of existence on the earth, endowed with manifold

faculties. Of the action of these, the best achievements of animals give no evidence. The outstanding features of this rational life, spring out of the power to reason from general principles towards a systematised view of existence. Testimony for the efficiency of this power appears in all directions. It is seen first in mechanical appliances, next in science, afterwards in unceasing efforts to construct a philosophy of existence, as a whole.

In tracing the lines of advance, as these are fixed by distinct phases of life in Nature, it has become apparent that there is need for large modification in our forms of discussion and in our use of terms. The most essential changes required are, withdrawal of references to 'mind' from our descriptions of the functions of instinct; a more exact discrimination of the higher mammals from subordinate forms of life; and a more clearly defined boundary line between 'mind' in the higher animals, and the rational power distinctive of man.

When we concentrate on the relations of the higher mammals to man, it will specially appear that more careful account needs to be made of the difference between two modes of recognising mental phenomena, the one direct, as in our own experience, the other indirect, as in observation of the actions of animals. There lies here a wide contrast. This marks a difference in the exactness, and even in the certainty, of our knowledge of the intelligence of the higher mammals. The directness of our knowledge in consciousness gives certainty, whereas any such exactness of statement is impossible, even from our most careful observations of animal life. The contrast between

these two modes of knowing, must be constantly in view. Strict guard must be kept against encroachment of the one mode into the province of the other, such as might induce easy acceptance of analogies in procedure of the lower and higher life. The need for this guard has been long insisted upon in the interests of physiology; it must now be insisted upon in the interests of psychology.

The results of our training of animals must afford the main test of their intelligence. Though there is no evidence that animals, even the highest mammals, interpret their own sensory experience, we have ample proof that the higher animals are capable of interpreting signs, for direction of their action. This is obvious in the case of the horse, the dog, the monkey, and the ape. This capability places these animals in closer relation with man, than proves possible for lower orders. After scrutinising in detail the whole circle of evidence,[1] we observe this limitation, that the exercise of animal intelligence is connected with direction of animal *activity*, not with acquisition of knowledge. Of this apparent restriction, explanation may be sought in our mode of observation, which is restricted to the actions of animals. But this explanation is clearly insufficient. The limitation is in the scope of the activity observed. Call the animal into action, and its intelligence becomes apparent. Leave the animal to itself, and signs of intelligence are either wanting, or are comparatively rare. As instinct always concerns forms of action, so it is here. When 'intelligence' appears in

[1] For this, I must refer again to *The Relations of Mind and Brain*, chap. vii.

animal life, this also is seen in direction of activity, though of a new and wider range, admitting of a degree of co-operation in work with us, provided we direct the animals in their efforts. But animals do not of themselves seek knowledge, as a dog seeks what will please its appetite. It seems as if intelligence were not dominant power, though existing in the life, and capable of being used and developed by us. Accordingly, we have no success in efforts to educate these animals, *education* being distinguished from *training*. So long as we seek to have the monkey to imitate our action, we succeed; but we do not get much beyond this. To refer here to the want of articulate language, is only to illustrate the difference. This want is not accounted for by absence of vocalising power. What we are remarking is really the absence of that measure of intelligence to which information gives interest, as in contrast with 'curiosity,' or sense of strangeness. Accumulation of knowledge by exploration and reflection is hardly, if at all, within the compass of these animals, even with all the advantages of companionship with man, continued for long ages. The dog is our best test here; in its history we have the largest results of heredity.

The contrast between training and education, here brought into prominence, has not received adequate recognition. Intelligence, as seen in an animal, commonly shows progress in the scope of its activity, not tentative effort to gain enlarged knowledge. This throws a serious obstacle in the way of an argument for continuity, favouring a belief in evolution of the higher intelligence from the lower. Evidence from contrivances to reach food; incidents of the chase;

and experiments in training, all seem to fail in supplying the kind of evidence required. Training falls short of educating. Its limits seem fixed by the measure of the animal's allurement by food and by caressing, or by the measure of its nerve endurance. If the animal were not so quiescent afterwards; if we saw it engaged in practice subsequently, as if to advance its own education, apart from inducements of appetite; if some gleam of the spirit of inquiry appeared, we should have more evidence to go upon. Observation of animals, whether in a state of nature, or under domestication, has not supplied data of a helpful kind. A cloud of uncertainty is thus thrown over all theorising as to animal 'ideas,' 'conceptions,' and 'reasonings.' If we suppose that we can convey an 'idea' to the mind of a dog, whatever difficulty there may be in describing the process, let us enumerate a few examples of the 'ideas' so transferred. We communicate ideas to human intelligence by use of language, by direction of personal observation, backed up by concentration of attention on the part of the recipient mind, and by conversation allowing for questioning and answering. How many of these can be employed in our communications with the animals? We doubt if any of them are available. The sheep-dog,—the Scotch 'Collie,'—the faithful attendant of the shepherd in the management of his flock, presents the surest and best test. The action of the animal in collecting and driving the sheep, when he is under direction of the shepherd, is a marvel. But what 'ideas' can we convey to a 'Collie'? Can we convey to him an idea of porridge, or of 'Dog Biscuit'; of whiteness or of hardness; or of anything more than can be appre-

ciated by his sense of smell, and his sight and his appetite? Do we get beyond interpretation of signs? The porridge and the biscuit, the white and the hard,—all influence his susceptibilities; but there is not sufficient evidence that he has 'ideas' such as we have, when we use these terms.

Risks of onesidedness need to be guarded against here. These may be escaped, by passing from comparative biology, into a section of our literature dealing with the characteristics of human intelligence. We shall thus be placed in possession of descriptions and definitions bearing on the intelligent life of man, which were shaped with no other end in view than that of securing an accurate understanding of our own familiar mental exercise. Take for example that section in the history of British philosophy represented by the names of Locke, Hume, and Reid. The three names are representative of three distinct phases of thought, while the thinkers are historically related. The combination of the three secures several advantages. Locke says the term 'idea' 'serves best to stand for whatsoever is the object of the understanding when a man thinks; I have used it to express whatever is meant by phantasm, notion, species, or whatever it is which the mind may be employed about in thinking.'[1] Hume distinguishes between impressions and ideas. By 'impressions' he means 'all our sensations, passions, and emotions, as they make their first appearance in the soul.' By 'ideas' he means 'the faint images of these in thinking and reasoning.'[2] Reid, conducting a polemic against

[1] Locke's *Essay concerning the Human Understanding*, Bk. I. Ch. i. § 8.

[2] Hume's *Human Nature*, Bk. I. Pt. i. sec. 1.

our regarding 'ideas' as objects of knowledge, instead of as forms of knowledge, keeps by popular usage in his definition of the term. He says, 'In popular language, idea signifies the same thing as conception, apprehension, notion. To have an idea of anything is to conceive it. To have a distinct idea is to conceive it distinctly. To have no idea of it, is not to conceive it at all. . . . Conceiving or apprehending has always been considered by all men as an act or operation of the mind."[1]

Without touching any of the questions in dispute between these several thinkers, we have among them sufficient agreement to supply the test desired. They are agreed that 'ideas,' such as we have, are the product of thinking; and that impressions, common to us with the animals, are excluded, as representing a simpler preliminary phase of experience. 'Thinking' is the common term in all these definitions, applied to the process by which ideas of things, or conceptions of them, are formed in our minds. By this process is meant a phase of mental activity which concerns itself with present and past 'sensations,'—forming out of these a general conception of an object, of a relation, or of a law of existence. There is no evidence that the higher mammals ever form such ideas, far less engage in this as a familiar occupation. Men are constantly forming such ideas or conceptions, of which language becomes the familiar expression. Contact with an external object makes an impression on the sensory, but it does not cause an 'idea,' if by 'idea' we mean a conception of the thing which has wakened

[1] Reid's *Essays on the Intellectual Powers of Man*, Essay I. Ch. i. § 10.

our sensibility. The sensation in our consciousness consequent on the sensory impression, does not cause the conception of the thing. Nor is the conception a faint reproduction of this sensation. Such revival of sensory impression may well occur in the brain on every occasion when we think of the object; but our idea or conception of a thing is made up by ourselves, by combination in a single representation of many qualities, recognised by us as belonging to the object. Often our 'idea' is at fault, and it is rectified, as the result of wider observation; but the detection of each fault, and its correction, belong altogether to more careful observation and thinking. Thus the 'idea' cannot be a fainter repetition of sensory impression. It presents an example,—quite a simple one,—of our exercise of Intelligence in the processes of observation, comparison, and constructive representation, the result of which we are able to image or reproduce at any time.

Hence an 'idea' is not a copy of any single object; conversely, what it is, is not represented by any single object; in order to be true to the variety in Nature, it could not be so represented. Thus, the rational power originates its own 'ideas,' is strictly the 'cause' of their appearance, and nothing lower than rational power, including within this, comparison and induction, could give us the 'ideas' which are the familiar possessions of our consciousness. Two things clearly follow: animal intelligence is of a lower type than human; and evolution of the higher from the lower is not supported by any evidence at command. When the functions of the two orders are placed in contrast, the result is adverse to the claims of the theory of

Evolution. Continuity which had been demonstrated in the history of organism, has not been traced in the relations of animal to human intelligence. This is only another way of expressing the conclusion, otherwise reached, that sensory impression cannot cause thought. There is not in the natural history of intelligent life any evidence pointing definitely in the opposite direction. There is a mass of convincing evidence for organic evolution under action of environment; there is none for evolution of human intelligence from that of animals. For test of this difference, nothing better can be done than to bring familiar examples of evolution into comparison with the ordinary facts of intellectual life. Take a single case of structural modification, such as the foot of the horse; take variations such as those seen in the several breeds of dogs, or of pigeons. With these examples in view, it is apparent in what perplexity we are involved, even in attempting to make out analogies. In the one case, there is a structural basis; advance can be traced through successive stages. In the other, we pass from the sensori-motor system, with brain structure, without being able to explain the appearance of animal intelligence, and in it we find no rudimentary phases of thought. The utmost found is, transference into action of the sensory impressions made by signs which we employ. Functions are now severed from physical structure. Or, lest this should seem too much, the facts recognised are not included within observations of structure, and its functions. In mode of observation, we are now separated from the whole field of natural history. This break as a simple fact must be deliberately stated as a condition of scientific advance. Scientific

observers insist upon non-interference. Psychologists must do the same, for there are two modes of observation, though not two methods of induction. The one is a mode proper to natural history as a science of organic life, the other proper to psychology as a science of intellectual procedure. While these two modes of observation are distinct, the rational basis of procedure in reaching inductions is the same. It is only because the phenomena of organic action and of mental are different, that we speak of two phases of life, two spheres of existence, distinguishing organism from mind. It is only because 'mental phenomena' in animal life are restricted to the lowest order of phenomena in our consciousness, that we are unable to acknowledge them as 'germinal forms' from which the higher functions could unfold. There is not here any analogy such as would place animal intelligence in relation such as that of the germ-cell to the mature embryo.

Everything contributing towards scientific inductions confirms the distinction we are now drawing. Take together law and results, in the field of organism. 'Natural selection acts only by the accumulation of slight modifications of structure or instinct.' We here recognise the co-action of environment and organism—pressure from without, inducing action from within. If we think away the external pressure, results are unattainable, forms of existence become stationary. This scientific hypothesis is the product of the thinker, who has in imagination placed things together, though they are visible only as things apart. Take now the rational power concerned in the elaboration of this theory. Where is the external

pressure, where its results? If we surrender external pressure, do we then part with 'natural selection' in the sense in which we have hitherto used it? If so, does the action of thought observed by us, fail to illustrate the law appearing in the co-action of environment and structure? To these questions there seems but one answer—the argument for continuity is untenable. The law itself does not hold, and 'accumulation of slight modifications' is not visible within the observations.

This conclusion is confirmed when we pass over to the higher mode of knowing, constantly referred to in these discussions. Let us now take this distinct standpoint, in order to consider what is to be understood by such phrases as these, gathered within the limits of a half-page of Darwin's discussion, 'the frame of mind,' 'several distinct mental actions,' 'mental faculties in animals,' and 'mental powers' as these appear in man.[1] Mental actions are classified as distinct; how are they distinguished? Is it not by absence of characteristics of organic action, and by presence of characteristics not observed in the sphere of organic activity? How otherwise can we account for classification of actions as muscular and as mental? To suggest that the distinction is verbal, not real, is to run directly into self-contradiction—a landing-place towards which science must decline to travel. Let us make good our classification, and what are the consequences? Negatively, 'mental actions' are not produced by structure in response to nutriment and external excitation; consequently these actions do not come under the law of natural selection, under which

[1] *Origin of Species*, p. 191.

organic results are measured by external pressure. Positively, 'mental actions' are the expression of a distinct power in Nature, and the 'several distinct mental actions' are dependent on this power. 'Thought' is the leading power in human life, whose exercise involves comparison, classification, and induction under laws of thought commonly recognised and applied, of which the law of non-contradiction is an example. Taking these tests, 'mind,' in its full significance, as now described, belongs to man; 'mind,' in a simpler phase, belongs to the higher mammals. In both cases 'mind'—intelligence in the sense of discrimination of the meaning of sensory impressions—must be pre-supposed as the condition of the actions described. Their occurrence cannot be accounted for either by repetition of any structural functions known to us, or by continuance of external pressure on organism, such as the law of 'natural selection' involves.

In these attempts to trace the natural history of Intelligence, we are now warranted in restricting attention to man and the higher mammals, seeking some general conclusion as to the relations of these two orders of life.

In the sphere of intelligence, the difference between the two gives immense superiority to man. Testimony is here explicit and ample from those who regard evolution as all-comprehensive. Special value is to be assigned to statements from such witnesses, even when psychological distinctions are not rigidly observed. Darwin has said, 'It may be freely admitted that no animal is self-conscious, if by this term it is implied that he reflects on such points as whence he comes, or whither he will go, or what is

life and death, and so forth. But how can we feel sure that an old dog with an excellent memory and some power of imagination, as shown by his dreams, never reflects on his past pleasures or pains in the chase? And this would be a form of self-consciousness.'[1] Considering the difference between the direct knowledge of our own procedure in consciousness, and the indirect knowledge of the dog's experience, how can we be sure as to the contents of an old dog's dreams? What we know of the physiological results of life-long repetition of functions along well-defined lines, warrants a conclusion favourable to re-awakened sensibilities, giving a physical basis for the sensori-motor activity, and for the barking, noticed often in the sleeping dog. Do not such manifestations belong even more to the comparatively young dog than to the old dog? Does not his master's voice readily stir the dog's susceptibilities in the waking state? Those things are of more consequence to us for the purposes of scientific inference, than the occasional and restricted phases of nerve excitement seen in the sleeping dog. Besides, all the symptoms described, including the barking, are produced by electric excitation of the cortex of the dog's brain. May we not, on this evidence, conclude that all these phenomena belong to the sphere of sensori-motor activity, restricting the interpretation of 'dreams' accordingly? To me, it seems that such restriction is required by the evidence. If so, the claim to self-consciousness, even in the restricted sense indicated, must be withdrawn.

When next we consider how much is involved in

[1] *Descent of Man*, p. 83.

denial of self-consciousness, it is admitted that the animal does not reflect on his prior existence, does not deal with the problem of life, nor with expectations of a future existence. Reflection concerned with such matters belongs to a superior intellect. Accordingly, Darwin has remarked that 'man, from the activity of his mental faculties, cannot avoid reflection.'[1] In one of his references to human Imagination, connected with our experience in dreaming, he says, 'The value of the products of our imagination depends, of course, on the number, accuracy, and clearness of our impressions, on our judgment and taste in selecting or rejecting the involuntary combinations, and, to a certain extent, on our power of voluntarily combining them.'[2] Strictly accurate all this is. Can we, then, attribute to the old dog 'judgment and taste in selecting or rejecting the involuntary combinations'? Does such reflection belong to the higher mammals? Denial of self-consciousness is the exclusion of all this. We here touch something quite distinctive,—something which cannot be attributed to the old dog's dreams. We are already moving on some of the nearer altitudes, unapproached by our best dogs. Yet, we are only coming in sight of the more familiar exercises of human intelligence, such as lead Dr. Romanes to speak of 'the many and immense differences that unquestionably do obtain between the mind of the highest ape and the mind of the lowest savage.'[3]

Granting, then, 'the many and immense differences' between these two orders of Intelligence, the theoretic difficulty for the evolutionist is proportionally great.

[1] *Descent*, p. 112. [2] *Ib.* p. 74. [3] *Mental Evolution in Man*, p. 20.

Whether the ape or the dog is to be preferred as the higher in intelligence, may be doubted. Evidence does not give a marked precedence to the ape. In form, it comes nearest to man, and this fact favours the hypothesis of later descent, and proportionate superiority intellectually. Besides, his use of the hand, in grasping things, gives him a marked structural advantage over the dog or horse. He can turn round an object, place it in different lights, and receive from it more varied impressions. But there are also numerous disadvantages. Thus, we have to reckon with this consideration introduced by Darwin: 'We should, however, bear in mind, that an animal possessing great size, strength, and ferocity, and which, like the gorilla, could defend itself from all enemies, would not have perhaps become social; and this would most effectually have checked the acquirement of the higher mental qualities, such as sympathy and the love of his fellows. Hence it might have been an immense advantage to man to have sprung from some comparatively weak creature.'[1] This reference directly concerns 'the higher mental qualities' essential to social life. Development of social life, as distinct from gregarious life, implies reflective exercise of that order special to man. The absence of this in the ape, places him at a vast disadvantage, as Darwin suggests. A large part of the advantage for the dog under domestication, has come through affection for his master.

At this point appears the weakness of the reasoning which would make the lower intelligence the source of the higher. 'The many and immense differences'

[1] *Descent*, p. 64.

do not readily find their cause in the inferior nature. Nor are difficulties much modified by reference to the influence of external pressure, material and social, on the life of the ape. Let us assign to animals the highest powers of intelligence which have been traced in any case, such as those found in the dog. We can readily grant to Darwin that 'these powers, which differ much in different animals, are capable of improvement.' But, it is impossible to sustain Darwin's inference, when he adds, 'There seems no great improbability in complex faculties, such as the higher forms of abstraction, and self-consciousness,[1] etc., having been evolved through the development and combination of the simpler ones.'[2] 'No great improbability' is a very guarded expression from a careful and acute observer. I think the improbability much greater that Mr. Darwin realised. The more the facts are pondered, the greater will the improbability seem. 'Development and combination' stand on different footing. Persistent use of any power will develop it, and full advantage must be allowed for this. But when the possibilities of combination are considered, difficulties come thickly. Combinations of sensory and motor apparatus are easy. These involve no more than increase in the number of fibres and cells. In view of the multitudes of both in the human body, this is an easy conception. But it is quite otherwise when we consider 'the many and immense differences that unquestionably do obtain between the mind of the highest ape and the mind of the lowest savage.' Improvement of simple faculties cannot lead to complex faculties. Advance in

[1] 'No animal is self-conscious,' above, p. 230. [2] *Descent*, p. 84.

acuteness of hearing can yield no more than increased susceptibility in this one form. If we next introduce 'combination of the simpler ones,' either we are dealing with mere association, or we have introduced some higher power, effecting the combination. In the latter case, the hypothesis of evolution is not sustained. Rational power is essential for production of the results contemplated, and is assumed to be in operation.

Accepting the guidance of the most ardent Evolutionists, we do not escape a sense of the weakness of the argument. To prove evolution of mind, we must open a road from sensory impressions to ideas of objects, and from these to general abstract ideas; and this must be such a road as the higher mammals could find for themselves, before man's appearance on the earth. Here is the essential test of an all-embracing scheme of Evolution:—to account for interpretation of sensory experience. Beyond this we seek a natural history of human thought, constructed on the observational method, and worked out on conditions supplied by antecedent existence, accepting the best results of animal intelligence.

This problem separates us from much that has been already assured in natural history, strongly favouring evolution. The facts are quite distinct from those bearing on structural development. An organ being given, we trace the history of its modifications through varying phases of adaptation to circumstances. In such a case, continuity is demonstrated on observational lines. Again, the facts are quite different from those illustrating continuity of stimulation along nerve fibres, onwards through the brain, and onwards still

by a set of motor nerves, to the muscles of a limb. Here continuity in the history of the executed movement is manifest. This is illustrated in the action of all organic life. Again, the facts stand in contrast with continuity observed in co-ordination within brain-structure. Thus, double organs of special sense are co-ordinated so as to give a unified result from the action of two separate nerve-fibres brought into relation within the brain. But 'the conception of an object' is not a continuance of sensory action. Conceptions of objects do not flow in upon the mind. They are made up by the mind through action of comparison, while utilising a past experience. We *receive* our impressions; we *make* our conceptions. Accordingly, we see many things of which we form no conceptions. Conceptions are often reconstructed, as the result of fresh observation. This severance from sensible experience becomes more manifest, when rational inductions are included, as when we recognise the law of gravitation, conservation of energy, or natural selection. These things do not arise in consciousness, as muscular movements are executed in response to sensory impression. Thought has a history very different, requiring a distinct explanation.

Here the psychology of evolution seems insufficient. Darwin has given a considerable gathering of phenomena, well summarised by Wallace. A glance may suffice to show the variety included. Within Part I. of *The Descent of Man*, which alone is devoted to 'the descent or origin of man,' we have extended illustration of the analogies of animal and human experience and action. Special value belongs to the facts gathered by

the observant eye of such a naturalist; but there is in their statement neither exact adherence to psychological distinctions, nor concentrated treatment of the main difficulty. Facts need to be redistributed and classified. In one group there are actions illustrating Instinct; in another, facts showing the Intelligence of the higher mammals; in a third the characteristics of Rational life. Here, we need to fix attention on the single problem presented by the relations of the two last groups. When a fair commencement has been made, by recognising common characteristics in animal and human intelligence, a dividing line must be drawn, separating mental phenomena which depend on exercise of rational power. Without this, the authenticated facts lie before us so mixed up, that it is impossible to handle them with scientific precision.

Wallace's later study, involving revision of the entire breadth of evidence and argument, has led him to the conclusion that the moral, intellectual, and spiritual faculties of man cannot have been derived 'by gradual modification and development from the lower animals.' Wallace thinks that an erroneous estimate has been made of the value of supposed 'rudimentary powers' in the animal life. The facts are as Darwin has given them, but they do not show such analogy with human intelligence as the argument requires. They do not present manifestations of a power adequate to account for 'the many and immense differences that unquestionably do obtain between the mind of the highest ape and the mind of the lowest savage.' For, as Wallace observes,[1] we must distinguish the facts of our mental development,

[1] *Darwinism*, p. 463.

from the facts illustrating evolution of mind in animals. Our development implies exercise of rational power; evolution of mind, if demonstrated, must be achieved independently of rational power. We cannot assume the action of the power whose appearance we are to explain. The argument as to mind must be separately developed, and on a basis supplied by organic structure. This has not been done in such manner as to support a plea for continuity. Facts seem to bear us away from the conclusion that 'mental actions' are analogous with 'organic.' Wallace has recognised this, even while accepting the conclusion that the human body is the product of evolution from a lower form. 'Because man's physical structure has been developed from an animal form by natural selection, it does not necessarily follow that his mental nature, even though developed *pari passu* with it, has been developed by the same causes only.'[1]

Wallace's discussion of the appearance of rational life in Nature is brief and condensed. The argument against continuity is, however, presented with much force, in his treatment of the mathematical, the musical, and the artistic faculties in man. This sectional treatment of the multifarious heaps of evidence has the disadvantage of appearing to cross the line at a point too far in advance. In any case, we must come to the essential difference between animal intelligence and rational. It is, therefore, better to face directly the single problem presented by the functions of rational power, as these are familiar to us. Through whatever by-paths we travel, we come at length to this question: can we account for the rationalising

[1] *Darwinism*, p. 463.

power in man by reference to animal intelligence? Besides the discussions of Darwin and Alfred Russel Wallace, we have more recent contributions of high value.

Dr. Romanes[1] and Professor Lloyd Morgan[2] have, with great deliberation and ability, devoted themselves to this problem. Dr. Lloyd Morgan specially has shown appreciation of the perplexities involved in the discussion.

The scientific problem concerns the origin of rational power as existing in Nature. Can its appearance be attributed to evolution of animal intelligence aided by a law of 'natural selection'? In reiteration of the terms of our problem, lies our hope for a final interpretation of the evidence. Let us take, first, the sensibilities of animals; their sign-giving, as in the danger-signal common among them; and the vocalisation which this involves. All these belong to animals low in the scale, for which a claim to intelligence cannot be vindicated. These actions are, therefore, permanently excluded, as bearing no testimony capable of being applied within the natural history of intelligence. Let us next take interpretation of sensibility, understanding of signs by which we communicate with animals, and the results of training, as these appear in the higher mammals to which we attribute a lower or simpler type of intelligence. The appearance of such intelligence among the higher animals cannot be accounted for by evolution from the lower forms of life. Sensibility provides for motor activity and for vocalisation. The area of activity

[1] *Mental Evolution of Man.*
[2] *Animal Life and Intelligence.*

in this case, is completely covered by organic apparatus. Experiments for localisation have shown that application of the electrode to a point in the dog's brain will induce barking.[1] The conclusion is, that all the phenomena falling short of interpretation of sensory impressions belong to organism, not to intelligence.

Let us next take animal intelligence itself, as recognised in the higher mammals, placing alongside of it the rational power of man, with his knowledge of things, his classification of such knowledge, his abstract ideas, his generalised truth, his rationalising of personal conduct, and his organisation of society under common law. Our question is, Have we warrant for concluding that this rational power is an evolution from the intelligence of the dog and ape?

Inquiry must be strictly confined, for the present, to the relations of animal intelligence to human intelligence. Classifications of emotions, as described by Darwin, included by Wallace, and enumerated in an extended list by Dr. Romanes, must, for the time, be set aside as subordinate to the main inquiry. The significance of these emotions turns on this question, how far such emotion may be dependent on intelligence or independent of it? To take only these two examples, fear and anger, it is obvious that experience of these does not require intelligence. These are certainly forms of experience included under the familiar feelings of animal life low in the scale. On the presence of such feeling depends common application

[1] Ferrier's *Functions of the Brain; West Riding Reports*, III., p. 150. I have given details in *The Relations of Mind and Brain*, pp. 99-103.

of the law of natural selection. It will presently appear that our estimates of memory and imagination must be restricted in like manner. In passing these, we do not overlook them as characteristics of animal life. We only fix attention on the action of intelligence in order to ask the single question: Can Animal Intelligence account for evolution of rational power?

We advance along the single available line, when we consider the relation of simple ideas to those more complex, inquiring whether there can be any causal relation between these two. We ask whether interpretation of signs can unfold into the higher exercises enumerated. We seek to have it decided whether those effects of training appearing in the intelligence of the dog, can be regarded as disclosing operations contributing towards evolution of human intelligence. Dr. Romanes, drawing upon Locke's discussion of the question, 'how far brutes partake' in the 'comparing and compounding' of simple ideas,[1] has directed inquiry along the proper line.[2] By following this, we may reach some clear understanding of the relations of animal intelligence to human. How do the 'simple ideas' of the dog, compare with the 'complex ideas' of man? The mental exercise of the animal must be placed alongside the reflective exercise of man. In this way, we may find it possible to say whether the simpler has potency for evolving the higher.

Keeping to the terms used by Locke, Romanes speaks of the 'comparing,' 'compounding,' and 'enlarging' of ideas; admitting that the procedure 'Locke has in view is the conscious or intentional comparing,

[1] Locke's *Essay*, Ch. on *Discerning*, Bk. II. chap. xi. § 5.

[2] Romanes's *Mental Evolution in Man*, p. 28.

compounding, and enlarging that belongs only to the province of reflection or thought.'[1] As to the animals, Locke's positions are these:—'I think beasts compare not their ideas further than some sensible circumstances annexed to the objects themselves.' Those who have most closely observed the intelligence of dogs, and have habitually worked with them, will agree with Locke's statements. Dr. Romanes, however, thinks that there is a 'comparing and compounding' of ideas by the higher mammals, though these exercises do not rise into 'the province of reflection or thought.' And he regards Locke as favouring this conclusion. But Locke's statement is in these terms:—'though they take in, and retain together, several combinations of simple ideas, as possibly the shape, smell, and voice of his master make up the complex idea a dog has of him, or rather are so many distinct marks by which he knows him; yet I do not think they do of themselves ever compound them and make complex ideas.'[2] If the reader turn back only a little way, he will find additional statements of moment. When dealing with 'considerations concerning our simple ideas,'[3] Locke identifies such idea with 'any perception in the mind' consequent on an object 'affecting our senses,' 'which may be taken notice of by our discerning faculty,' as a 'real positive idea in the understanding.' And when Locke comes to speak of 'discerning and other operations of the mind,'[4] in that chapter from which Dr. Romanes quotes, he opens the chapter thus,—'Another faculty we may take notice of in our minds is that of discerning and

[1] Romanes's *Mental Evolution in Man*, p. 29.
[2] *Essay*, Bk. II. chap. xi. § 7. [3] Chap. viii. [4] Chap. xi.

distinguishing between the several ideas it has. It is not enough to have a confused perception of something in general; unless the mind has a distinct perception of different objects and their qualities, it would be capable of very little knowledge.' Let us, then, consider the natural history of this power of 'discerning and distinguishing between the several ideas' in consciousness.

There is a marked difference between that compounding which is only association in experience, as when the dog recognises his master by 'shape, smell, and voice,' as 'so many distinct marks by which he knows him;' and the compounding which is the result of deliberate comparison. What we do attribute to the dog is the distinguishing of his master by sight, by smell, by hearing; for he is clearly guided by any one of these; sometimes by one, sometimes by another. We do not, however, attribute to the animal the comparing and compounding of these impressions; so as to form a conception of the distinctive qualities which give rise to them. We recognise only correlated sensory impressions, and their effects in action. Sensory impressions, carried by molecular action along the nerve-fibre to the nerve-cell, and through that to the motor-nerve, and so onward to the muscle, is a continuous course of action which we attribute wholly to organism. These are common functions of organic life. 'Mental phenomena' do not appear within this area. We do not attribute intelligence to any animal on the ground of these phases of action. To identify 'mental phenomena,' we must get beyond these. Rising above them, we remark how the animal interprets our signs, when we

direct his actions. Actions of this kind we attribute to intelligence, as being beyond the functions of organism. The intelligence here seen at work is indeed commonly connected with the excitement belonging to action. It does not show any beginning of a power of comparison of ideas and objects. Without this, Locke says, the mind is 'capable of very little knowledge.' If this be the utmost we can claim for the animal most highly trained by man, the case for evolution is not sustained. There does not appear in the facts adequate explanation even for the appearance of animal intelligence, and still less for the appearance of rational power of man.

The reference to 'compounding' of ideas has proved misleading. Such compounding is not mere agglomeration, or fusion as by chemical affinity. 'Comparing and compounding' are here distinct parts in a single process. Without comparing there is no compounding,—no building up of knowledge. We place together marks known separately. A 'complex idea' is thus an 'organised' conception, which can have no place, even in 'germinal form,' except on condition of comparison. Without exercise of this power, the sensibility ends as the impression fades away. The gate opening to that key which rational power applies, remains barred in face of a humbler instrument. Before this barred door, neither the natural power of the animal, nor our power of training, proves sufficient. Into this wider sphere of rationalised knowledge, none of the higher mammalia can come. Where sight, smell, or sound guides, animals can follow without misgiving; when general conceptions are formed and expressed, their powers are of no avail.

Appeal has been made to memory and to language for help through this barrier, but this is grasping at supports quite beyond reach. Memory and vocalisation prior to comparison are of no avail. Neither are memory and language available when dependent on it. In the first case, they do not cause comparison; in the second, they only retain and express its results. Such appeals mix up things altogether different, placing them under common names. 'Memory' belongs to animals, quite low in the scale, to whom intelligence is not attributed. Such memory is only a cumulative result belonging to sensibility, apart from understanding. The same animals use signal-sounds, but these express only recurring experiences of pleasure or fear. Neither is intelligence involved in these cases, nor is there anything which could originate it. The 'memory' of which we speak as peculiar to man, depends on the exercise of thought for its materials, and so is it with the language we use, which is the expression of thought itself.

As to the theoretic value of a memory such as that which does duty in the service of comparison, Dr. Romanes supplies striking illustration, while arguing for an opposite conclusion. Connecting with Locke's reference to 'perception,' as the true type of a 'simple idea,' Romanes suggests that we use the terms 'percept,' 'concept,' and 'recept,'—the first indicating knowledge from a single sensory impression; the second, the combination of a variety of perceptions,—'a taking together,' the 'recept' being the recalling of what has been already present, a 'taking again,'—'a recognition of things previously cognised.'[1] This use of terms

[1] *Mental Evolution in Man*, p. 36.

is good, the connection of the three is clear in their order, and the dependence of the third on the two first is manifest. 'Recepts' presuppose 'concepts.' The mind is only 'taking again,' what it had secured first, by its own effort in constructing the concept. As concepts are thus presupposed, the waking of 'a faculty of discernment' is already implied. Nothing is in this case contributed by action of memory at all helpful to an argument for evolution, when the express aim is to give a natural history of thought. The power of discernment does not grow out of memory. In course of its own working, discernment shows also the action of a higher memory, to which it assigns a new order of work.

Nor is it possible that Language should account for the appearance of rational power in the world. Language is an instrument of thought; an evidence of the presence of thought; a subsequent and consequent of the exercise of rational powers. 'The fact of the higher apes not using their vocal organs for speech, no doubt depends on their intelligence not having been sufficiently advanced.'[1] To appeal to language is to cross the natural history line at a point too late to find causes at work capable of producing rational power. It is only to record as a fact under observation, that whose appearance we have to account for. The language which expresses first our general concepts, and thereafter the relations of thought to thought, presupposes thought. Language is external to thought, an outward product having no meaning, if there were not first thinking power to construct both the thoughts and the language.

[1] Darwin's *Descent of Man*, p. 89.

Vocalisation, like facial expression, is a physical result depending on the action of brain, nerve, and muscle, and, on this account, belongs readily to mere organic life, appearing as it does far down the scale. What is expressed, depends upon what is already within the life. To refer to barking, neighing, chattering and whistling, as if they might be the source of human speech, is to expose the argument to ridicule. Examples of vocalisation they certainly are; so long as we speak of them as precursors of speech, we are within the record; but when we point to them as efficient in evolution of speech, the best that can be said by way of excuse is, that we are confounding vocalisation, mere physical utterance, with the grammatical structure of language. How widely these two things are apart may be readily seen. When Darwin says, 'I cannot doubt that language owes its origin to the imitation and modification of various natural sounds, the voices of other animals, and man's own instinctive cries, aided by signs and gestures,'[1] he is speaking of vocalisation, the use of physical structure for emission of sound. Several naturalists have gained singular skill in imitating the calls of animals, finding in this many advantages for observation of their habits. But this is an acquisition difficult for a man, because it is a matter of imitation, not an expression of natural feeling. When Darwin further says,—'the same language never has two birthplaces,'[2] he is speaking of the history of diverse tongues, as these involve grammatical structure, and use of signs liable to modification, in the history of thought. The first quotation refers to vocalisation as

[1] *Descent*, p. 87. [2] *Ib.* p. 90.

a physical process; the second to naming of things as a mental process. It is the combination of these two which appears when written language is spoken. We cannot err so egregiously as to confound the two processes. The difference between the vocal cords, and thought-power, is plain enough. Their combination in a single course of action, as in familiar interchange of thought, cannot mislead us, as if sound were the cause of thought; or as if thought were being originated by the vocables falling from our lips. Vocables vary according to traditional usage, even when the conceptions expressed are identical. It is on account of the identity of conceptions, that translation is easy. Thought is the antecedent condition, finding expression for itself in conventional forms. Laws of thought are far apart from laws of vocalisation. The severance is so great that it is impossible to confound them, as it is impossible that the two forms of activity should cross each other. Of vocalisation, physiology gives a scientific account; of thought procedure, and the laws directing its movement, physiology affords no explanation. Thoughts are transitory, as are our utterances. *Verbum volat irrevocabile.* Yet words are fixed. The national language remains, while citizens emigrate or die. But thought gives to words their significance, as it gives form to language as a whole, determining the life-history of its words. It naturally follows, that the instrument which thought creates is useful in the history of mental activity. Words are as the tools we use. But for its utility, the instrument would not be produced. It will be cast aside, as soon as a better has been invented. 'A name is a word taken at pleasure to

serve for a mark which may raise in our mind a thought, like to some thought we had before, and which, being pronounced to others, may be to them a sign of what thought the speaker had, or had not, in his mind.'[1] Mill naturally adds, 'Names do much more than this; but whatever else they do, grows out of, and is the result of this.'[2] The name or mark, however much it may express, does not account for the thought uttered. Beyond this, vocalising is a function of organism; various forms of sensibility and of excited feeling in animal life find vocal expression, in sounds varying according to diversities in structure. All vocalisation thus belongs to the history of signs; articulate language is the highest product in this history. But its life-history, so to speak, is quite distinct. Vocal organs and their use do not help us here. We are concerned with internal causality. The contrast between organic and mental action is so marked that vocalisation is reduced to a subordinate position. Physical fear finds physical expression in animal economy, as in the scream of the blackbird when a cat is seen crouching near. Physical joy finds utterance in like manner, as in the barking of a dog, when his master starts for a walk. Thought expresses itself in the naming of things observed. The difference is vast. What we mean by 'mental,' in contrast with 'organic,' is manifest here as elsewhere. 'All names are names of something real or imaginary; but all things have not names appropriated to them individually. For

[1] Hobbes's *Elements of Philosophy*, Pt. I. chap. ii. § 4. Molesworth's *Collected Works*, i. p. 16.

[2] Mill's *Logic*, Bk. I. chap. ii.

some individual objects, we require, and consequently have, separate distinguishing names; there is a name for every person, and for every remarkable place. Other objects, of which we have not occasion to speak so frequently, we do not designate by a name of their own; but when the necessity arises for naming them, we do so by putting together several words, each of which by itself, might be, and is, used for an indefinite number of other objects; as when I say *this stone*, 'this' and 'stone' being each of them names that may be used of many other objects besides the particular one meant, though the only object of which they can both be used at the given moment, consistently with their signification, may be the one of which I wish to speak.'[1] The sign which expresses thought is very different from the sound which is the expulsive utterance of strong animal feeling. Hence, in the activity of the rational life, marks and signs are employed even more widely than vocables. If a stone-hewer chisel out a stone on the hillside, and mark it with a stroke of blue paint, in token of property in the stone, thought and purpose are expressed by the paint; so it is when the forester marks with red the trees not to be cut, while others are being felled; so it is when sound takes the place of colour, the only difference being that in the one case appeal to the understanding is made through the eye, in the other case through the ear. If we regard such signs as testimony to the existence of rational power, we are correct; if we adduce them as causes of the appearance of thought, we err. Explanation of the appearance of rational life can

[1] Mill's *Logic*, Bk. I. chap. ii. § 3.

not be found in the history of language. Dr. Romanes is unfortunate in the prominence given to language throughout his discussion of the relations of simple and complex ideas,—of 'percepts' and 'concepts.' He says: 'The word "idea" I will use as a generic term to signify indifferently any product of imagination from the mere memory of a sensuous impression up to the result of the most abstruse generalisation.'[1] His classification of ideas he gives in the following form: 'By "simple idea," "particular idea," or "concrete idea," I understand the mere memory of a particular sensuous perception. By "compound idea," "complex idea," or "mixed idea," I understand the combination of simple, particular, or concrete ideas into that kind of composite idea which is possible without the aid of language. Lastly, by "general idea," "abstract idea," "concept," or "notion," I understand that kind of composite idea which is rendered possible only by the aid of language, or by the process of naming abstractions as abstractions.'[2] The references to memory and to language are too conspicuous here; the references to action of intelligence too slight. If a 'simple idea' is defined as 'mere memory of a particular sensuous impression,' this so-called 'memory' may be mere recurrence of excitation dependent on sensitiveness of the nerve fibres. This is not 'memory.' Recurrence of excitation is not recollection. Take, for example, the dog's smell of food awakening appetite. If this sensuous impression were renewed with return of hunger, there would be revived activity of the

[1] *Mental Evolution in Animals*, p. 118. This is the weak point in H. B. Medlicott's able discussion, *The Evolution of Mind in Man.*

[2] *Mental Evolution in Man*, p. 34.

sensory apparatus, such as occurs under physiological law in the history of any animal. This may explain what is involved when we speak of 'a dog' dreaming.' Memory 'is the knowledge of an event or fact, of which meantime we have not been thinking, with the additional consciousness, that we have thought or experienced it before.'[1] To define a simple idea as a memory of a sensuous impression is misleading. There is nothing in the experience of the animal entitled to be called an 'idea,' no process which can be described as 'ideation.' Some higher power is needed for the origin of an idea or image combining qualities in a single representation. Thereafter, memory may recall it, with consciousness that we had previously formed it, and had kept it before the mind. There is 'revival in the mind of an image or copy of the original event.' 'But such a revival is obviously not a *memory*, whatever else it may be; it is simply a duplicate, a second event, having absolutely no connection with the first event, except that it happens to resemble it.'[2] That animals form 'concepts,' or get any further than the recognition of 'so many distinct marks' by any one of which a thing is identified, seems to remain doubtful. When Mr. Leslie Stephen says that 'a dog frames a general concept of cats or sheep, and knows the corresponding words as well as a philosopher,'[3] there is no evidence to support the statement. When Darwin quotes this with approval, as a remark which 'may be extended to the more intelligent animals,'[4] he illustrates facility of faith, rather than the security of

[1] James's *Text-Book of Psychology*, p. 287. [2] *Ibid.* p. 287.
[3] *Essays on Free Thinking*, p. 82.
[4] *Descent of Man*, p. 89.

legitimate induction.[1] On the same lines, must we not say that a blackbird forms a concept of a cat; and that an insect forms a concept of a ripe bud? Utterances of this class are unsustained by observation, and create disadvantages for research.

Let us keep to the single question of comparative intelligence, as illustrated in the dog and in man, afterwards seeking along this line the origin of 'the most abstruse generalisation.' Whether the dog does combine the several characteristics of his master in a single complex idea, seems doubtful. As Locke said, these may be 'only so many distinct marks by which he knows him.' The need for reserve as to inferences from memory must be admitted. But we may grant that, if a single sensuous impression may be recalled, a simultaneous combination of sensuous impressions may be simultaneously recalled. This is simple in human intelligence. We form complex ideas such as 'tree,' 'horse,' 'house.' If it be said, as by Sully, that there is here 'a passive process of assimilation;'[1] or if we say, with J. S. Mill, that 'the characteristic visual appearance of an object easily gathers round it by association, the ideas of all other peculiarities which have in frequent experiences co-existed with that appearance;'[2] it is only thereby shown with what facility our intellectual processes are executed. On the other hand, it seems thereby to become more difficult to attribute such mental exercise to 'the more intelligent animals.' There seems more to favour Locke's representation that the animal has only 'so many distinct marks' by which he knows an object. Most commonly

[1] *Outlines of Psychology*, p. 342.
[2] *Examination of Hamilton's Philosophy*, p. 403.

direct sensory impression is supplying a prominent part, when we remark on the intelligence of the dog. Amongst our observations there is little to suggest that he is 'occupied' with ideas, or guided by complex ideas. Whatever uncertainty remains here, we are at least agreed that the higher mammals are capable of interpreting simple sensory impressions, and this is certainly a higher exercise than 'the mere memory of a sensuous impression.' If this statement is warranted on evidence, it seems to follow that the origin of animal intelligence cannot be found in the sensori-motor system centered in the brain. Sensuous impressions stand distinct from intelligent discrimination of their meaning. There is a marked difference in this respect between the impulse to worry a sheep which sight of the flock may stir in a dog, and readiness to gather them together under order of the shepherd.

When we turn from these investigations to observe human intelligence, the difference is such as to involve us in the utmost difficulty if we attempt to trace the 'rudiments' of the higher intelligence in the lower. Long ages of training have not lifted the dog to a place of independent intelligence. The intellectual process is conspicuous in all *our* effort. Rational discrimination is at work, even in 'passive combinations' of sensuous 'perceptions' which depend on several sensuous impressions. We distinguish sensuous impressions, and are cognisant of several perceptions in a single experience. These we blend in one complex idea. We could not represent tree without including trunk and branches; or horse without including form, limbs, and hoofs. When further we contem-

plate rational power in full exercise, accumulating observations and advancing towards wider inductions, animal intelligence presents no causality adequate to account for its origin. Among the essential characteristics of a self-directing intelligence are application of laws of thought, self-criticism of thought, use of prior inductions, and accumulation of knowledge, sustained by a living interest, practical, literary, scientific, or philosophic. The powers we are agreed in assigning to the higher animals, even on the highest computations of them which have been made, offer no traces of the rudiments of such rational exercise.

This conclusion is strengthened when it is remarked that the highest achievements of animal intelligence observed by us are the results of human training. Man's influence has been at work through successive ages in development of the dog and horse. When account has been made of this, difficulties for the theory of evolution are multiplied. Although monkeys and apes have the advantage in brain structure and in powers of manipulation, they have not shown intelligence coming to the level of our domesticated animals. On these grounds, it is demonstrated that the origin of the higher power cannot have been the lower. Natural history itself fails to sustain evolution of rational power.

This conclusion is further strengthened by the testimony of Geology as to traces of the presence of the dog and the horse on the earth. Hitherto we have included the results of domestication and training. Now these must be excluded, retaining only biological conditions, historically antecedent to man's appearance in Nature. Our observations must apply

exclusively to the forms of life assured to us on historic evidence as precursors of this event. Here the records of Palæontology supply our only available testimony. When these determine our conclusions, it is impossible to find in the horse and dog progenitors of our race. Our best examples of animal intelligence are thus withdrawn from the circle of evidence available for Evolution. For historic accuracy our lines of thought must be in large measure reversed. In accordance with the conclusion to which all evidence is certainly leading, we need a greatly extended view of man's place in Nature. For it is true, as has been admirably said by Sir Robert Ball, that 'the advent of intelligent beings on the globe has certainly introduced a factor into evolution, the full import of which we are not at present able to appreciate.'[1]

[1] *Fortnightly Review*, April 1892.

CHAPTER VIII

RATIONAL LIFE

By a lengthened course of investigation we have traced a path through the fields of comparative biology. Now at length man's place in Nature comes fully into view. His is a life far in advance of all that belongs to a merely animal existence; it is a life separated even from that which most closely approaches to his own. Comparative biology, however valuable, is insufficient as a guide to a complete representation of human life. Man's life is, indeed, dependent on environment, as other life is; but independent, as no other life can be. His is a life allied with all organism by his subjection to the common laws of growth and nutriment; at the same time, he moves in a rational sphere where these laws have no application, and where other living beings can have no companionship with him.

My aim here will be to present, at least in outline, the activities of the rational life. It forms no part of my plan to give prominence to special gifts among men, representative of possible attainments or accomplishments, even though these have continual illustration in society. Mr. A. Russel Wallace has done this effectively by discoursing of the mathematical, the musical, and the artistic faculties in man.[1] It is

[1] *Darwinism*, p. 464; *v.* Weismann's *Essays*, vol. ii. p. 31.

obviously reasonable that such selection of faculties should be made; for by reference to these a strong argument can be adduced for the distinctiveness of human intelligence. But it is more in accordance with the plan here followed, that the common characteristics of human life should be taken as representing most naturally and adequately the comparative position of man. Accordingly, I here regard man as man, without being specially concerned with higher gifts and accomplishments in possession of the few.

A self-regulated life is a unique representation. This is characteristic of all men alike. We find it in rich and poor, in cultured and illiterate, in savage and civilised. The distance which separates the extremes of civilisation is a vastly extended one; innumerable varieties are to be found between; but all men share in rational self-direction as their birthright. However low he be in the scale of civilisation, a man cannot be treated as if he were irrational, or incapable of being the coadjutor of his fellow-man, whose accomplishments he does not share. To understand the place of man in Nature, we must observe how truly men move on the same elevation, possessing common powers of self-direction, all claiming common rights, all admitting common obligations.

There are many disadvantages to the inquiry as to man's place in the world's history, from considering closely and continuously his life in view of its affinities with the characteristics of animal intelligence. Of necessity, in such a case, we turn attention away from the grander features of human life, found even in the most ordinary, or lowly, or even dishonourable, of human lives. Contemplated at the distance of remote

periods, supposed to be those in which were 'the beginnings of civilisation,' man is regarded as if through a reversed telescope. We talk of men as if they were a pigmy race, lower than are found in the forests of Central Africa. As if by constraint of logical consistency, we begin to speak of 'the ancestors of man as, no doubt, inferior in intellect, and probably in social disposition, to the lowest existing savages,' and we are, quite logically it may be, impressed with the large acquirements which have been stored up throughout the long ages which have elapsed since that 'extremely remote epoch before man had arrived at the dignity of manhood.' All this may be not only warranted, but even necessary to anthropological research; but it is apt to carry with it a logical penalty, as if we were chargeable with a breach of continuity when we describe the elevations of a rational life. Nevertheless we must speak of what man is, a thing about which we are at least more sure than we can be as to what man was. We must besides pay homage, as aforetime, to the thinkers of antiquity, who have impressed us all by their force of intellect. At the same time, we do not wish, as if under apprehension of straits into which our argument may be brought, to hasten off to the few men of special gifts, or to chosen men of varied accomplishments. We desire to consider such a man as we now have wherever we meet him, humanity as it exists in our own age. We seek to describe what a rational life is in itself, whatever its environments, and however chequered its course in the world. We all believe that there was a time in the world's history when animal life held the field. I seek now to describe

with some precision what the new life was which appeared in the later times, though at an indefinitely remote period from our own age, when rational power took its place, introducing 'a new factor into evolution.'

The conception of a self-regulated life stands in contrast with animal life, even with the animal life belonging to man himself. This contrast, if clearly developed, will present the first stage in our representation of rational life. A development of the negative side of evidence will enable us to trace one of Nature's boundary lines, helpful towards adequate survey of the wide territory of biology. Organism is ruled by sensibility, and ultimately by environment; rational life is ruled by neither. This difference breaks the biological continuity. A theory of evolution here encounters criticism of a kind altogether different from anything directed against it at an earlier stage.

The representation of animal life has been placed before us with considerable amplitude in course of the preceding investigations. The general interest awakened by repeated restatement and extended illustration of Darwin's observations, has made the public mind familiar with the fixed conditions of animal life. This proves a special assistance now, in attempting to trace the lines which sever all animals from man. There is here some compensation for the disadvantages just mentioned. The marvels of the process of organic growth baffle conception; the conditions of subsistence and of activity lie open to observation, and are generally recognised. Sensory nerves, brain, and motor nerves are the common possessions of organism. All organic activity is the

work of brain, nerve, and muscle. This applies to all animal life, including that of man. Such life as this is dependent for its continuance on environment. Nutriment is the condition of subsistence. Out of this, emerges the 'struggle for existence,' and out of this, 'survival of the fittest,' and from this, by laws of heredity, transmission of acquired characters; and out of this, 'origin of species.' We are familiar with this whole set of combinations; inductions which have been gained for us by concentrated scientific research. It is now possible to lift our heads from it all, in order to consider how it bears on the general order of things in the midst of which we find ourselves.

The first perplexing consideration, threatening to bewilder for a time, is the fact that this boundary line includes humanity with animality. The representation is not in any sense a new one. We had always said that man is an animal; we had often said, rather confusedly it is true, mixing up in a single formula things that differ, 'man is a rational animal.' The novelty of the situation lies in this, that man's alliance with all animal life has been established with a clearness and fulness of representation never before possible in the history of the world. The long hidden secrets of nature are disclosed, and behold! man has his heritage among the beasts of the field. The discovery is, indeed, a large one; the demonstration has been worked out in minute detail, till no place is left for doubt. However tedious may be the inductions bringing us to new truth, we are wonderfully swift in our deductions. The conclusion was suddenly drawn, as if it were 'an intuition' of science, that man had been dethroned, dragged from the place of honour.

It seemed as if an 'unexampled hurricane' had passed over the scene, and his abode had vanished. True, man is apt to be found alive when the hurricane has spent its force; he has an awkward habit of building his abode again, after the old dwelling has been destroyed, and of walking forth in the quietness of the evening, to look on the clear sky, bright as aforetime, just as if nothing singular had happened.

Nevertheless, something not only new, but great, had happened, in this demonstration of man's heritage among the animals. The new truth arrests the imagination. The range of animal inheritance includes man. In embryonic life, he is like to the animals: strangely like: so closely allied that it proves difficult to distinguish embryonic man from ape, or dog, or calf, or even from the rabbit. We are low enough, indeed, in the scale, when comparisons are concerned with embryonic history. From the period of birth, man's distinction is plain enough, it is true; it seems as if the lost dignity were being restored a little, when we see how an infant differs from a calf. But we cannot part in summary way from humble associations, for the baby-man does not so greatly differ from the baby-ape. We are again somewhat perplexed as to our ancestors, or, if the question is not quite so serious, at least as to our kinships. Even this may not be so serious as it looks, for we have kinship with all animals, not merely with the higher, insomuch that kinship is only a question of 'degree,' involving no great elevation for the apes, if it do not involve special degradation for men.

The fact now to be fully recognised is, that the boundaries of animal life include man. The

beginnings of organic life in the egg, the stages of progress in embryonic history, animal activity depending on sensory nerves, brain, and motor nerves, and even dependence on environment for nutriment and for manifold conditions of life, all hold as to man. It does not seem, indeed, that this seriously concerns the pre-eminence of man, for we are all agreed with Darwin in speaking of 'the dignity of manhood;'[1] and we must make full account of this dignity.

The first manifestation of a self-regulated life, lying nearest to the field of research which has occupied us hitherto, is found within the physical sphere itself. The laws of physical existence do, indeed, apply to the life of man, for he has his place among the animals. But the 'dignity of manhood' begins to appear even here. This animal life of ours is a distinctively human life, being a physical life rationalised. Animal life here appears under conditions, and in relations, found in no other case. The unity of our life must be regarded; the animal and the rational are characteristic of the one life. To interpret human activity, we must remark that the physical and mental are quite distinct, yet the origin of all the more important activity is from the rational power of man. The rational life is the loftier; its activity so far independent of the lower, that, as Descartes said, we can think away the body, while that which thinks continues its ordinary exercise. Even to the least cultured intelligence, among uncivilised tribes, it has seemed natural to think of the departed kinsman as living and acting in another sphere.[2] Experience of the difference between manual labour and personal re-

[1] *Descent of Man*, p. 46. [2] Tylor's *Primitive Culture*.

flection, favours such thought. But the truly striking thing is, the fact that the rational life enters into and regulates the physical life. There is no exception to this rule under the normal conditions of human life; there is no illustration of it in any other phase of life. The physical nature of man is subject to physical law, just as every organism is; but, in his case, rational power takes possession of the physical, turning it to use as its own instrument. This appears in all our ordinary occupations. It is involved in every case in which our Will is the source of physical activity, working out a rational purpose previously formed in our own consciousness. Pass away from his work, whatever it be, to consider the man's life, as a whole, and it is a rational life, even if judged only by physical manifestations; yea,—and this is still more striking,—a rational life, even when most irrational. Indeed, that which we describe as 'irrational' is so described, only as belonging to a rational life, which should have been better ordered,—a life which shows its rationality, even in its irrationality. Take it at its best, and at its worst, and it becomes clear that this physical life is quite different from the physical life of all the orders enumerated in comparative biology. The difference is that a rational life holds possession. The animal cannot be irrational, simply because it is not rational. On this ground, reflection belongs only to man. There is nothing either new or strange in his physical life itself. It is a more wonderful organism than any other, more complicated in differentiation, more intricate in co-ordination, but the same in model of structure, and function, as all organism, high and low. Everything possible can be

said as to homology of structure; every stage in physical development can be traced in harmony with those of the ordinary animal life, of any grade you may select. Thus, during the successive stages of embryonic life, as we have seen, there is exact analogy with the embryonic life of the animals. Pass thence to contrast mature life, in the several cases, and what do we find? During this more advanced period of existence, there is no analogy in the life of the animals with the rational guidance of the physical life in man. The separation is complete. Nevertheless, this difference does not imply that man is separated from physical law. There is no such modification of law, nor is there exemption of any physical life from its dominion. Man is subject to physical law, exactly as are the oxen, and even as the rabbits of the field. To him animal wants, and appetites, and passions, are just what they are to these. But to him, the proprieties, the regulations, the restraints, the virtues even of a physical nature, are realities, and of the highest significance too. This is a first interpretation of 'the dignity of manhood.' But for these characteristics of a sovereign intelligence in the physical sphere, the power of man's higher life could not become manifest,—could not find room for itself,—could not breathe freely, nor find scope for its energies. What human life is, we know; and we are well aware that it could not be what it is, without its power to take possession of the animal nature, so as to establish dominion of reason. All men, indeed, do not practise rational restraints. We know it. But we lament it, and we condemn the neglect, as irrational and wrong. We spend no such lamentation and condemnation

over the animals. The sense of our rationality saves us from such a thing. All men know the powers and responsibilities of a rational life. In accordance with this knowledge, we think and speak, and regulate things in society. Hence the difference we make between the sober man and the intemperate. Hence denial of our hospitality to the man who cannot be trusted to appear in a condition deserving a welcome. Self-regulation of physical craving, is a first requisite of the rational life. It is a power manifestly in possession of every man, unless it be sacrificed by irrational indulgence. Thus did Socrates keep rigidly to the interpretation of our nature, when he declared that temperance is the foundation virtue in human character. This is simply the proclamation of the truth, that the rational nature must take possession of the physical, ruling it as a constituent part of a rational life.

In passing onwards to sketch the familiar characteristics of intelligent life, as concerned both with knowledge and practice, I would guard against abstraction. Let us take life in the concrete, keeping closely by physical conditions all the while. There is nothing to gain, everything to lose, by one-sided treatment of this many-sided life of ours. Whether, therefore, we regard man as he moves in a world of knowledge, or in a world of action, we see the rational in the physical. Rational power and physical are correlated in the field of activity. When we deal with 'mental phenomena' we do not part from 'physical'; we only remark how different they are, while observing that they are closely connected. When we speak of 'mind,' we do not forget to speak of 'brain,' though it is best when we are least aware of its existence;

but it is impossible to claim that 'brain' in man essentially differs in structure from brain in the ox, or in the dog; or that it has additional functions beyond those providing for intelligent regulation of physical action. These brains are too nearly akin to the human brain to admit of such claim to superior functions for man's brain, as would account for the superiority of his life. All the higher functions of human life belong to consciousness; they are known only within the hidden realm of experience, which every man occupies for himself, without entrance of visitors. To know, to consider, to plan for the future, to shape a purpose for immediate action, and to execute it in word or deed, these belong to the individual man,—to every man, whatever his place among the millions of the race. They belong to no other being on the earth. To vindicate this position, there is no need for here dealing with achievements of scientific research, or with subtleties of metaphysical speculation, or with the learning of the Schools, or with any of the specialised forms of intellectual effort. We are speaking of the ordinary man in his ordinary life; and we find that for him it is a possibility, even a necessity, that he know things around, and that he begin early to gather knowledge, and to practise reflective exercise, as no animal does. This is the realm of 'mind' in human life. To suggest that it is the realm of organic activity is to hazard a statement not only without evidence, but in contradiction of it. Take biology first; take psychology next. In the region of biology it appears that, consequent on complete dependence on environment for their gratification, the interest of the animal life centres in a series of sensations.

By contrast, the interest of man is in all things around him, and in all the relations of things, as distinct from supply of his bodily wants. It is in this way that Mr. Herbert Spencer[1] answers those who contend 'that psychology is a part of biology, and should be merged in it.' Throughout biology proper, 'the organism and its correlated phenomena practically monopolises the attention.' Hence the induction, 'The life of every organism is a continuous adaptation of its inner actions to outer actions.' 'But in psychology the correlated phenomena of the environment are at every step avowedly and distinctly recognised;' not merely those phenomena related to the wants of organic life. Hence the propositions of psychology refer 'to its multitudinous, special, and ever-varying phenomena.' The rational life concerns itself with *all* that is around, surveying the whole field of existence lying open to contemplation. Man has an eye for more than meat. On account of this higher interest, the wants of the organism, though quite as urgent for him as for the animal, drop into a secondary place within the sweep of his observation and effort. Even for the man most removed from civilisation, for example, for the red Indian, who roams the forest, and for whom supply of food is the main concern,—this end of his efforts bringing him into as close analogy with that of the animal as human life can be,—that forest has attraction which only rational power can concern itself with. The forest is his country; there are tracts there, and varieties of trees, and a luring wealth of light and shade, and harmonies of sound, and places of shelter, and signs of coming

[1] *Principles of Psychology*, vol. i. p. 134, Pt. ii. § 54.

changes of weather and season. How different for the animals which are in a sense part-proprietors, as having their dwelling and hunting-ground within the same territory! Whence this difference? It is not merely that the man has a more complex organism; that in his frame there are co-ordinations of which no trace could be found in the captured game. As for the man, does he not know the whole place; and if a fancy crossed his mind that there was some part in it which he did not know, would he not wish to know it? If the civilised man came from his civilisation to wander in these parts, would he not desire to know exactly what the red Indian does know? Would he not seek his guidance and friendship?

'One touch of nature makes the whole world kin.'

This is, then, a second phase of the rational life, eager search for knowledge everywhere. As the organism craves food, the mind craves knowledge, and feeds upon it in all its forms, delights in it in all its varieties. 'Organism and the environment which meets its wants' is too narrow a realm for man. He walks through the scenes as a free man, desiring to have all nature speak with him.

On this line there open up to view marked contrasts in the scope and character of the activity belonging to a rational life. Let us still keep to the ordinary life of the ordinary man, including all rational life without exception. Let us say that a man toils for his meat, just as the fox does, just as the dog does, just as these gulls in their flight do. What then is the difference? He hungers, as they do; he hunts, as they do; he kills, as they do; he eats, as they do. The

animals may do all these things as well as he;—some of them may manage better than he can. The difference which severs man from the animals lies beyond the craving, and the cunning, and the consuming of what has been captured. We trace it in his plans for the day, in his preparation of his weapons, in his survey of the heavens, in his taking of reckonings for direction. He deals with the relations of means to ends; he utilises past experience in his reflections over what has happened; he reaches general conclusions. All these may for him be preliminary work, before physical effort quite like to that of the animal; but these are the characteristic exercises of the man, showing within the narrow limits of such a life as that of the red Indian, what are the possibilities of a life within which accumulated knowledge reckons for much more than all animal impulses together, even when at their most exalted pitch. This marks the difference in range of meaning when we speak of 'variation' in animal life, and the growing experience of the rational being. The one is physical, the other is mental. The one is organic modification, the other is accumulation of knowledge. Let us say, with Russel Wallace, 'most animals have such a surplus of vitality and strength for all the ordinary occasions of life, that any slight superiority in one part can be at once utilised.'[1] The statement does not seem too strong. But, in its strength, it shows vividly the two separate lines of advance. In the life of the animal it is by the way of organic variation; in the life of man it is by the way of reflection, accumulating knowledge, extending experience. Gain

[1] *Darwinism*, p. 418.

for the personal life is always in this way, even when progress includes some phase of physical advance, which infrequently is not included.

If we use the language adopted under the scheme of evolution, we shall see that when taken as the dominant law, it is applicable exclusively to animals. 'Organisms are acted upon by the environment, which produces in them definite change.'[1] We do not allege that human organism is not acted upon in this way. We recognise climatic influences, and physical results coming from concentrated physical effort, belonging to some forms of employment. Man is subject to the laws of organic life in these ways, just as the animals are. But when we speak of personal advance, under a dominant law, we speak of progress by means of observation, reflection, and growing wisdom. In such a case, the words just quoted have no application. Yet, it holds for all lower life, that 'organisms are acted upon by environment, which produces in them definite changes.' The law of individual advance is distinct in the two cases. In marking this difference, we part company with all that has been written as to the action of environment, and as to 'natural selection.' These have only a slight bearing on the physique of our race; they have no bearing on development of personal life; neither upon acquisitions of knowledge, nor upon formation of character. The rational life takes its course independently of these, acting for itself in accordance with knowledge, gaining nothing towards its development by being acted upon by the forces of Nature. All that men have been constantly saying as to

[1] *Darwinism*, p. 418.

personal effort, and obligation, and responsibility, stands unaffected by acknowledgment of evolution as the leading feature in the history of organic life. This conclusion becomes the turning-point in the discussion, and is henceforth to be kept constantly in view.

The full effect of the contrast now brought out, will be seen if we mark the *severance* of the two forms of activity, as these are distinguishable in human experience. The physical activity and the mental are different, and are known to us as different. Not only so, they are known to us as separate in source. This places the contrast in a vivid light, even while it remains true that there are secrets of physical activity, obviously those of brain action, which research has failed to disclose.

In man, body and mind are distinct, while they are constituents of a single life. This appears in the distinctness of the sources of action, and in the difference of the laws under which action in each case proceeds. Observe how the evidence stands. We take evidence first on the *negative* side. The activity of mind is not continuous with activity of bodily *sensibilities*. Environment produces sensory impressions; but it does not produce our thoughts, our plans, our resolutions. These mental actions are not effected by mere continuity of stimulation along the sensory line, as if the result reached were something registered in the brain, or some extended movement generated there, within certain circles of co-ordination. The first and readiest hypothesis from the biological side fails. There is no analogy between the muscular movement which follows sensory impression, and mental activity when it follows that impression. The

one is *continuous* under the same laws, passing through the nerve-cells to the nerve-fibres, and continuing onwards to the muscles. The mental activity is *discontinuous*. After sensory movement has reached the nerve-cells, it is not propagated by the aid of nerve-fibres, or other physical structure. Sensory impressions end; intellectual activity comes from a distinct source. It comes to receive these new impressions, in harmony with its own generalisations in the past. Here is the contrast between man, and animal. Here also is the contrast between physical and mental in the life of man himself. An object moves among the bushes; the movement arrests the eye of the cat, and of the dog, and of the man, in exactly the same way. All three at once turn towards the moving object. By all three, the movement of the eye is similarly effected. The movement in each case is a reflex, dependent on the sensory impression, and bringing similar muscles into use. We account for what has happened in the three cases, by reference exclusively to nerves of sensibility, to nerve-cells stimulated in the brain, and to motor-fibres brought into use to work the muscles. But there is no such continuity of action when thought and purpose are formed by the man. No action of nerve sensibility can reach rational generalisation, or work up such generalisation, so as to originate it. The man remarks that the movement which has arrested attention is that of a bird, that the bird is a bullfinch; and desiring to protect the bird, he calls back his dog, and drives away the cat. In this course of action, nerve-cells and nerve-fibres are called into use, just as before, and these work just as they operate in every

organism. The vocalising involved in calling the dog's name: and the muscular exertion in getting between the cat and the bird, are executed by the intervention of the brain and motor nerves. In executing these movements, there has been a discharge of nerve energy, the 'explosion' of nerve force from the central organ, which has set the muscular system in action. Continually there are incoming nerve-currents, and outgoing nerve-currents. Everything of this kind is physical, quite apart from the rational exercise peculiar to man, and is accomplished by bodily apparatus, just as are the movements of the cat and of the dog. The forms of reflective exercise are, however, *discontinuous*, because proceeding from a different cause. The incoming nerve-currents do not account for the thoughts of the man, or for the purpose he forms. The subsequent actions of the man, illustrating his dominion over the animals, are executed by the nerve power and the muscular, within compass of the mechanism. In marking that the thought of the man is not continuous with the movement of the incoming current, though correlated with it in time; that the action of intelligence is interposed by the man within his own consciousness; that the reflective exercise is not even 'movement' in any sense analogous with that recognised in activity of a nerve fibre, we observe that our rational life is distinct from our physical. It is not subject to the laws regulating molecular movement of nerve-fibres, and stimulation of nerve-cells, and 'explosive' discharge of nerve-energy. This presents the negative evidence.

Let us take, next, the evidence on the *positive* side. This is supplied within our consciousness, while we

carry through our reflections and form our decisions. We consciously originate, continue, and conclude our own reflections. Assigning to enviroment and to organism all that has been indicated above, in the movement of the bird, and in the sight of the movement contemporaneously with the sight of it by cat and dog, we are, apart from these, conscious of our own agency in the exercise of intelligence. We identify the bullfinch, by reference to the class to which it belongs; and when, quite instinctively, let us say, the desire to save it arises, our decision to act is matter of consciousness. If, instead of this, we had lifted a stone, and thrown it at the bullfinch; that also would have been our act, for which we should have been responsible, whatever the source of the impulse, simply because we are rational agents. No one thinks the cat responsible for his spring, or the dog for careering among the bushes with noisy yelp. We do not spend our breath on arguments with the animals; nor do they complain of neglect on this account. As Erasmus suggested in the *Praise of Folly*, we cannot 'call a horse unhappy, because he was never taught grammar, nor an ox miserable, because he was never taught to fence.' But when there is a child to hear and understand, we do think it of consequence to speak of kindness to animals. The testimony for the rational life is first and supremely, that of consciousness. Our own knowledge of our own activity, gives certainty. Of this knowledge, we have no explanation apart from our own agency in the exercise of intellect, for which the functions of the nerve-system afford us no explanation. Concentration of attention, use of past experience, reflection

as to what is prudent, kindly, or right, are actions wholly within our consciousness. There is no trace of explanation of them within the ramifications of the nerves and nerve-cells. The facts of our own life are the surest to us, and those selected are quite ordinary examples. The familiar agency of thought in its direction of our conduct, is known to us all, even to those who know nothing of nerve-fibres and nerve-cells.

Observe now how the argument stands. Nerve-structure accounts for all that belongs to the sensibility of our bodies, and for all that illustrates the power of our muscles. Structure of brain accounts for concentration and co-ordination of the two sets of movements, accomplished by apparatus, such as is within all organism, and is of uniform structure within all. Consciousness includes no trace of the antecedent molecular movements, within fibres and cells. Consciousness alone gives the knowledge of our own experience, in the direction of our reflections, and in the determination of our actions, involving government of our impulses, and management of our bodily movements. Physiology includes no trace of all this. After the molecular movement has reached its terminus in the nerve-cell or cells, the nerve-system offers no further contribution to knowledge, until we come back to the sphere of the muscular sense. There are thus two distinct phases of activity; so distinct, that the one is not continuous with the other, in respect of energy and movement, though continuous in time. The continuity manifest in organic action is broken, being transcended and supplemented in human life. Unity of life is undoubted at-

the top of the scale, just as at the bottom of it; but, when the life of man is considered, unity of action is no longer traceable by external observation. The source of nerve activity is within; that activity does not originate from environment. This difference is one of vast significance. Biology has no account to make, no explanation to offer, of the most potent agency in Nature. The conscious experience and activity of man, while it cannot be explained apart from environment, cannot be explained by it; while it cannot be accounted for without continual reference to the activity of the organism, it cannot be interpreted as lying within the laws of organic action. The next stage of the argument follows logically. If we have not continuity of action in accordance with which activity of organism can pass over into activity of mind, —evolution of organism cannot carry an explanation of the appearance and development of mind. Even as a member of the physical world, the distinction of man is not in his organism, but in his power to use it as he does. This is the testimony for a rational life, disclosing the vastness of the change in the world's history, which is consequent on the appearance of rational agency.

Consider how biology is placed in view of the demand for a scientific account of rational life. It has claimed that man belongs to Nature, and the claim is valid; but it fails to include man's intelligent activity. Biology is not a completed science of Nature. It cannot make good its claim to be so regarded. The science of mind outstretches the science of biology. Man's life is superior to all animal life, possessing powers which are not shared by the

animals; having possibilities and a destiny, peculiar to himself,—impossible to organic life, even to the organism which is part of his own being, and which he uses as the instrument held to the service of his own rational purpose, uses, however, with endless tear and wear, telling of its coming dissolution.

This conclusion as to the inability of biology to present a science of human life, is reached by exhaustion of all that biology has to offer by way of explanation. All that has been demonstrated as to the action of the nerve-system, is accepted, and turned to full use. Within this is included all that has been ascertained as to the action of brain. As our knowledge of this wonderful central organ has extended, it has become more obvious that it carries no explanation of the activities of the rational life. As localisation of its functions has advanced, the difficulties of the biologist in making good his claim to include the activities of the rational life have increased. As convolutions and cells, and intra-cranial relations have been brought under observation; as the intricate demands of co-ordination within this elaborate central organ have been considered; as we have contemplated distribution of all the sensory impressions, and transference of these to the complex muscular system, it has become increasingly clear, that the demands on the central organ for maintenance of the integrity of an organic life are such, that the still more complicated and varied activities of the reflective life cannot also be concentrated here. They stand before us unexplained. There is not even a beginning made with an explanation of the higher phenomena of the rational life. Biology, rich in its possessions as to structure and functions,

is destitute of possessions concerned with the activities of intelligence. The marvels of organism, and the marvels of the rational life, stand quite apart. Science by its advance has completed the demonstration of its own insufficiency to account for the rational power, and for the grand consequences in Nature, which have followed upon the appearance of rational life within it.

This demonstration is also the demonstration of the insufficiency of a theory of evolution. By reference to its terms, as represented in the development of the egg-cell, in the structure of the mature embryo according to the originating species, and in the slow laborious advance of species by slight modifications in structure, the hypothesis is shown to be a scheme of organic evolution. As such, its insufficiency is demonstrated, by the evidence adduced in proof of the inadequacy of organism to account for the activity of the rational life.

The last retreat of the biologist is to say, that he does not know how much may yet be discovered to be within the compass of brain power. But consider of how little avail such a refuge is. It is only an isthmus lying between two large and well-explored territories, the well-known organism on the one side, the well-known life of consciousness on the other. Science has now penetrated so well into brain structure, that the biologist has only a narrow retreat within this isthmus, — for a scientific mind, a poor living-place, every day being narrowed, to the extreme discomfort of the tenant. We know well the distinctive characteristics of mental activity,—its reflective exercise, its concern with all that can be

known, its regard to the lessons of observation, its inventiveness in use of instruments, its government of conduct, its formation of character, its respect for the rights of others. In sight of this wide and varied range of activity, the biologist is invited to complete his conquest, to show us how he proposes to include this rational power which, in the world's history, has been traced as far back as we have traced the abodes of man.

Fortunately, we can afford to dispense with further historical research, for the problem is that of our own life. The facts are within reach of every member of the race. But, even with evidence thus available, the biologist is badly placed for advance. For, as Professor Tyndall has effectively shown, the observation which is concerned with structure and functions of brain cannot pass over into consciousness, any more than an ordinary man, in directing physical movements, can pass over from consciousness to brain action. There is a chasm between these two which cannot be bridged. All traces of continuity of action from the physical side, lose themselves in this chasm and never reappear. The biologist is halted on the further side, finding it impossible to cover the intermediate space. Every man lives consciously on the other side of the chasm,—is always there, does all his work there, stores his knowledge there, forms his plans there, gathers all the largest and most enduring results of his life there. All biologists are themselves living in this position. There is no agnostic retreat here. We know with certainty what our thoughts are, and what are our feelings and hopes dependent on these, and what are our efforts after self-control, and what

is our success in self-government. All this wide field of effort is familar to us,—much better known than the latest results of research into the structure and functions of brain,—and of all this wide and exalted activity, biologists are unable to give us even a fragment of explanation. Those who have spent a large amount of energy in inveighing against introspection, must resort to it, even without the consolation of an alternative. How can we know, save in our own consciousness? How can we regard our fellow-men as rational, save by the knowledge we have in ourselves of the exercise belonging to rational life, and of the manner in which we thereby direct our action? 'You believe that in society you are surrounded by reasonable beings like yourself. You are, perhaps, as firmly convinced of this as of anything. What is your warrant for this conviction? Simply and solely this, your fellow-creatures behave as if they were reasonable; the hypothesis, for it is nothing more, accounts for the facts.'[1] And how can we know what it is to act reasonably, except by our consciousness of rational reflection, and of guidance of our conduct, whereby we interpret the words and deeds of our fellow-men?

Now we have reached the standpoint, whence a full view of man's nature may be obtained. In the life of every member of the race there is duality in unity, unity in duality. This double aspect of the life can never be obscured. In the individual there is body and mind; two distinct lives, yet one life. The two lives are, nevertheless, so distinct, that we, as reflective beings, have no difficulty in contemplating the body

[1] *Scientific Use of the Imagination*, by Professor Tyndall, 1870.

as non-essential to the mind. This supplies the first key to the world-wide belief in a future state. Moral conditions supply a second. Yet, is the unity in duality so complete, that human life is never to be interpreted, can never have its actions fairly judged, can never have its potentiality truly measured, except on its admission. There is a double life in one: there is unity in the double life. A biological representation of man is impossible. There are two distinct natures, subject respectively to laws of quite different order. These two, organic and spiritual, are capable of being unified only by the governing power of thought, never by the mere energy coming from organism. Those who represent body and mind as only two sides of the same thing, see only what biology presents to view, organism, its laws and functions. From this point, the other side cannot be seen. It does not come into view any more than the other side of the hill does, to the man who looks upon it from the plain. The advantage to the tourist is that he can climb to the summit, and thence see the other side. But it is otherwise with those who regard man only from the side of organism. There is no summit within reach, and no way through. As we have seen, in the hopelessness of the attempt to pass from nerve-action to consciousness, the dualism in our nature is made conspicuous in ordinary experience. What has been seen, on the one hand, as to the *discontinuous* in the action of physical sensibilities, the *terminus ad quem* of molecular movement, and its insufficiency to produce, or explain, thought; is a view of organic life. What has been seen, on the other, as to the action of intelligence, in directing its own reflective

exercise, and thereby regulating physical action, is a view of the mental life. There are 'two sides' of the nature, certainly, but they are two forms of life, each with its own distinct *centre* of activity—brain, the centre of all organic action; intellect, the centre of all rational effort. The brain cannot do what mind does; mind cannot do what the brain does. We thus obtain two visions of human life, incapable of being blended in any single glance, or of lying within the area of any scientific observation. We can no more see with the eye into the conscious life, than we can see into the consciousness of a fellow-man. On the other hand, we can no more be conscious of the structure and working of the organ of vision—the Eye, which Plato likened to the soul—than the Soul can show itself in the visible world. Such duality is an altogether new thing in the history of life. It is new to science. Biology has no counterpart to show. Of the reality, there is clear proof. Whatever difficulty there may be as to the moment in individual life when the soul appears—whatever uncertainty as to the natural law regulating its appearance as part of the inheritance of the race, there is no doubt of its presence. To include an explanation of the rational life is an obvious part of the demand on modern science. Only in recognition of this duality, and at the same time in unreserved acknowledgment of life's unity, can human nature be understood. 'Two sides of the *same* thing' is an impossible representation. It includes no account of the governing power of intelligence, the grand distinction of humanity. This order of life transcends organism and its functions. Equally impracticable is the representation of man as purely

spiritual, overlooking the fact that the limits and the weaknesses of a physical life are component elements in the life of mankind. Such a duality is man's life, at once physical and rational, subject to lower and to higher orders of law, the lower applying to the physical nature, the higher governing the rational life. This combination determines man's place in Nature. It discovers his kinship with the animals; it accounts for his lordship over them all.

Only by sight of this two-fold nature, harmonised in the individual life, is it possible to account for man's place. It is a place occupied from birth, and as easily held as occupied, unless the man himself set lightly by the spirit within him, seeing and feeling and caring mainly for the animal, and that as only man can do, by using the rational power merely to minister to the animal nature. It is strangely in the power of the individual to wreck his humanity. Nature is too potent to admit of this in animal economy; Nature has left room somewhere for this, the peril of the embodied spirit.

Through this inquiry, a way is traced to a representation of man's life which may be accepted as including all the facts, doing honour to biology equally with psychology. It gives a doctrine of his organic life which does not break it off from its place in the order of Nature, and a doctrine of the soul, which does not place it apart from the system which is being wonderfully interpreted in our day, for, in the midst of it, human intelligence finds unlimited scope for research.

From this point of view, we take our survey of human life, still leaving exceptional gifts apart, that

we may consider the race as a whole. We present human life in no ideal colours, but, as it commonly appears, its beauty soiled by contact with the earth. We take man, low and high, always intelligent, always moral, commonly religious; and we seek to understand his place in Nature. Taken thus, even on the most commonplace levels, we do not find that any adequate account of man's appearance is given by reference to lower orders of life. We do not find in the 'rudiments' of organic life any trace of the potentialities of rational life. We quite understand how Darwin felt warranted to speak of 'the infinitely larger power'[1] belonging to man, in comparison with that belonging to the lower animals. We rather wonder at Darwin's conclusion, though we cannot critically object to it, when he says: 'In what manner the mental powers were first developed in the lowest organisms, is as hopeless an inquiry as how life itself first originated.'[2] We recall, besides, that this difficulty pressed so much upon Mr. Darwin's mind, as to have induced him, in his earlier work, to write a statement so unexpected as this,—'I may here premise that I have nothing to do with the origin of the mental powers, any more than I have with that of life itself.'[3] He began by assuming life; does it not seem that in like manner, in order to construct a scheme of human life, the mental powers must be assumed? Stronger support for the theory here maintained, could not be looked for from a biologist of authority so conspicuous. After such acknowledgment in both of his more celebrated books, do the words not sound as the

[1] *Descent of Man*, p. 85. [2] *Ibid.* p. 66.
[3] *Origin of Species*, p. 191.

expression of settled conviction, stronger even than the attractions of a favourite hypothesis?

The characteristics of the rational life are familiar to us all. They do not need to be described in detail, so well are they known. The fact constitutes considerable part of the difficulty experienced in constructing such an argument as the present. Still, there is for us this advantage, that the life to be described is our own, and that of our fellows around. It is human life as it appears everywhere in society. In man, the spirit of observation is perpetually active. Nature is man's first and most constant teacher. These eyes, roaming hither and thither, are in the service of a mind open to the influences of Nature's beauty and grandeur. In all diversity of situation, of social life, and of daily occupation, man lives in constant converse with his fellows. Whatever the subjects of talk, memory's stores are constantly being utilised. Man's present is ever full of recollections, enabling him to live in the heart of past achievements. 'Man, from the activity of his mental powers, cannot avoid reflection; past impressions are incessantly and clearly passing through his mind.'[1] In his daily activity, his classification of objects is a necessity of his conversation, as he talks of trees and horses, of glen and mountain, of men and communities. Still further do we penetrate into the characteristics of a rational life, when we mark how essentially it is a self-directing moral life, perpetually making account of things right and wrong. 'A moral being is one who is capable of comparing his past and future actions or motives, and of approving or disapproving of them.'[2] What other

[1] Darwin's *Descent of Man*, p. 112. [2] *Ibid.* p. 111.

being makes such drafts on past and future, even running forward in fancy, to condemn what will never be done, in order that achievement may excel that which has been fancied? We trace a moral element in all thought, amongst high and low, civilised and uncivilised, noble and criminal. In the midst of all the rivalries, jealousies, and antipathies of social life, presenting an evil side to view, there are constantly appearing references to right and duty. Thoughts and words, and pleadings for right, are strangely commingled with manifold forms of wrong-doing. What is the revengeful feeling, bursting out in flame of lurid passion, but a man's testimony against the wrong which has been done to him? How do we account for such force of passion? It is not animal passion, even though there be much of animal feeling associated with it. There is here only a superficial resemblance to animal conflicts. There is thought, behind this rush of feeling; on the tongue, there is complaint against a fellow-man, and just complaint; or, if you have doubt of this, at least reference to justice, as sovereign law to which every member of the race is appealing from day to day. To this great rule of human life, the little child appeals against strength of muscle which can lift him in the air, and set him down anywhere and anyhow. To this appeals the native of 'the dark continent' against the white face, who is suspicious, hasty in judging, unfair in punishing, having his finger too quickly on the trigger, under shades of night,—testimony this from the uncivilised against the bad side of civilisation. To this appeals the criminal, in the heart of our surging crowds, placed under arrest, if he should be

condemned on insufficient evidence. To this appeals every buyer in the market, defrauded by the thrusting of adulterated goods into his hands. And to this does every gentle one make appeal, defrauded in ways still worse, by false expressions of love, from whose falseness recoils a blighted life, bearing, through long and weary years, witness to the cruel wrong which has been done. Where, along the devious paths in which man is found, is justice not honoured, at least by outcry against harsh wrongs? Is not this other, the true excellence of life, seen walking more peacefully, and with large sense of good, in unflinching and willing acknowledgment of equal rights for mankind of all colours and ranks and classes? Not merely within sight of the strange medley of ill-doing and well-doing, but in the midst of it, where is ever recurring sense of wrong, and most earnest striving after right. Religion appears, for this is the soul's appeal to the Eternal,—man's elevation in thought, in feeling, in hope, when he lifts his eyes to the Father of all. From under the shadow of all clouds, from the heart of all miseries, in deepest sense of life's perplexities, man asks that question, which can have but one answer, 'Shall not the Judge of all the earth do right?' Along this darkened, troubled pathway, a man rises into calmer sense of elevation, swayed by desire for consecration to the righteous and merciful Father of our spirits, to whom he would have all men gather; a penitent, sensible of the presence of 'the power which makes for righteousness.' It were a poor description of rational life, which did not include all this. Wherever we be, we have but to turn our eyes in any direction, in order to see the mystic forms of

morality, and religion. Through all differences of race and rank, in all scenes near and remote, these companion visitors are helping to make the feeble strong, the strongest noble, lifting even the most mangled form from depths of self-inflicted injury.

There is nothing easier than to write about the greatness of human life, yet there are few things more difficult. I prefer to have a sketch transferred to this page as it has been touched off by a master hand:

> . . . . . 'What a piece of work is a man! How noble in reason! how infinite in faculty! in form and moving how express and admirable! in action how like an angel! in apprehension how like a god! the beauty of the world! the paragon of animals!'[1] . . . . . .

True to Nature! Yet is this the description of man as he is contemplated, at his best, in the ideal, with regard to his rational power, to his range of thought, and to the potentialities belonging to a rational life. It is such a description as we accept when we regard man in the dignity of his manhood, when in our consciousness we make account of his higher relations as a moral and spiritual being. Such a description, from the hand of the dramatist, may stand alongside the philosopher's view, as when Kant describes man's insight into moral excellence:

> 'Every example given to me of virtue must first be compared with the principle and standard of morality, to know if it be worthy of being elevated to the rank of the archetype or pattern, and so of course cannot originate in us the notion. Even the Holy One in the gospel is only recognised to be so, when compared with our *ideal* of moral excellence.'[2]

[1] *Hamlet*, Act II. Sc. 2.
[2] Kant's *Ground-work of the Metaphysic of Ethics*, chap. ii. Semple's Translation, p. 19.

Shakespeare shows his appreciation of the greatness of the rational being, as he moves in the world; yet is that greatness so associated with things lower, that we do not marvel at the suddenness of the transition, when, in immediate connection with the words quoted, Hamlet says: 'And yet, to me, what is this quintessence of dust?' We are speaking of one of whom we can say in the same breath, akin to the angel, and akin to the animal. And are not the union of these two natures, and the severance of the two, the facts which we must mark and ponder if we are to understand what man is, and are to contemplate his possible destiny?

Does not everything in the life of the individual depend on how he controls the animal in him, and develops the rational life? Is it not through the risks and possibilities of conflict, that the inherent 'dignity of manhood' is seen? Are not the possibilities connected with action of intelligence so lofty, even at man's lowest, that he contemplates a sovereign rule of moral life, and accepts this task as belonging to the inherent responsibility of a rational agent, to govern all motives in accordance with this rule? Is it not in this way, by homage to Conscience, and by exercise of Will, that our manhood comes into view, making us all acknowledge its dignity?

> 'Give me that man
> That is not Passion's slave, and I will wear him
> In my heart's core, ay, in my heart of hearts.'

Recognition of this led Plato to say, 'the man having a good soul is good.'[1] This supplied the central

[1] *Republic*, III. 409.

position in Aristotle's *Ethics*, 'deliberate preference seems to be a test of character, even more than actions are.'[1] The commonest man you find anywhere; the poet, honoured all the world over; and the profoundest thinkers, in times ancient and modern, are agreed in acknowledging that the greatness of man appears in his regard to sovereign law, securing the rights of all, from the weakest to the mightiest, and calling upon every man 'to do justly and to love mercy.'

There is no loss of force for our argument when, passing from this ideal, we are constrained to look into life's dark perplexities. The darkest things are worse than the worst in animal life. There is no attempting of a completed view of man's place in Nature, without giving prominence to this fact, apparent everywhere, and nowhere more glaringly than in the crowded city of our modern civilisation. To some who dwell mainly on the continuity of all life, a baser phase of human society may seem natural, a thing which may be regarded as a 'survival,' the breaking out of the animal forces, the rumbling echo of the thunderbolt; and yet in another aspect, when 'the dignity of manhood' is considered, and also the date now reached in the world's history, nothing can seem more unnatural than a low aspect of social life in the core of the most advanced civilisation. 'Survival' is too easy a way of meeting the case. We are dealing with a worse than animal debasement. This is no mere survival or reappearance of what has been. It is a lower and more perplexing order of things than science has

[1] *Nicom. Ethics*, III. 2.

unravelled and described, through observation of lower forms of life, whether those which have disappeared or those still continuing. The scientific explanation is inadequate. The debasement witnessed in man is impossible in animal life, impossible except when intelligence magnifies animal passion, and ministers to animal indulgence. There is not a trace here of the normal organic life, any more than there is a trace of 'the dignity of manhood.' The two natures, the intelligent as well as the animal, appear even on man's lowest level, but the better nature has become subject to the worse, and this has been induced by a course of self-chosen indulgence.

Let us here assign to scientific testimony the utmost that can be claimed. In stating at the outset the 'evidence for evolution,'[1] we gave from Mr. Herbert Spencer a quotation which may well be reconsidered in this relation. 'Organisms may vary not only in respect of their structures, but in respect of their tendencies to do this or the other in all kinds of ways, many or most of the ways at variance with welfare.' Every one will see that, variation being granted, it must always imply risk of deterioration as well as promise of advance. These possibilities go together. They are, indeed, suggested in the doctrine of 'survival of the fittest,' which implies deterioration of individuals, and even of some races, leading, it may be, to their disappearance. This belongs to the plan visible in Nature, appearing there as a condition of progress. But this seems to fail in supplying analogy to the moral evils appearing in human life. In order that some definite conclusion may be reached here, it is

[1] See p. 5.

important that full value be assigned to the evidence for deterioration in animal life.

In treating of 'reversion' as a fact noted by the natural historian, Darwin points to the phenomena of 'arrested growth' as a phase of reversion, in a measure an illustration of a lower structural stage.[1] It is doubtful if these facts can be taken as evidence for reversion. Darwin next refers to variations occasionally appearing in human structure, which wear an aspect of reversion. He refers to occasional peculiarities in the formation of bone, formation of teeth, and arrangements of muscles, characteristic of the apes. These facts have more obvious value, but they are all variations in organic structure, having no direct bearing on the question now before us. This Mr. Darwin indicates when, at the close of the discussion, he says, 'These various cases of reversion are so closely related to those of rudimentary organs given in the first chapter, that many of them might have been indifferently introduced either there or here.'[2] The only other passage of consequence is that in which the effects of civilisation on the progress of our race are considered. Here it is pointed out that 'although civilisation checks in many ways the action of natural selection, it apparently favours the better development of the body, by means of good food, and the freedom from occasional hardships. This may be inferred from civilised men having been found, wherever compared, to be physically stronger than savages.'[3] Mr. Darwin approaches more closely to the present stages of our argument when he touches on the relations of civilisation to moral life, remarking, 'in regard to the

[1] *Descent of Man*, p. 36. [2] *Ib.* p. 43. [3] *Ib.* p. 135.

moral qualities, that some elimination of the worst dispositions is always in progress even in the most civilised nations.'[1] He is referring to such facts as these, that 'malefactors are executed, or imprisoned for long periods;' that 'melancholic and insane persons are confined or commit suicide;' that 'violent and quarrelsome men often come to an untimely end;' that 'intemperance is so highly destructive, that the expectation of the life of the intemperate, at the age of thirty for instance, is only 13 ·8 years, whilst for the rural labourers of England, at the same age, it is 40 ·59 years;' that 'profligate women bear few children, and profligate men rarely marry,' and that 'both suffer from disease.' A deliberate survey of these statements will uphold them all as supported by familiar evidence. This admitted, it seems singular, in view of the argument for evolution in which our author is specially absorbed, that he should have written the introductory sentence in the terms quoted, —'some elimination of the worst dispositions is always in progress *even in the most civilised nations.*' Would not this appear the most likely of things under advancing civilisation? Should not the evolutionist regard it as one of the things to be expected, and to be adduced with prominence, and with all the formalities of detailed evidence, as contributing towards the support of his main contention, that the rational life is an evolution from the organic? Some elimination '*even* in the most civilised nations'! It is an utterance of the latent admission that in the midst of civilisation entirely new conditions have appeared. It points to the obvious fact that in the midst of

[1] *Descent of Man*, p. 137.

human life there is a freedom of action which is absent from animal life. It is preparatory for the acknowledgment, to be made only a little further on, that 'with civilised nations,' so far as the moral life is concerned, 'natural selection effects but little.'[1]

With this reserve of statement as to civilisation, there is recurrence to animal life, in a manner which makes the difference of plane in the two cases more conspicuous. In immediate connection with the examples of 'some elimination of the worst dispositions' in the midst of our modern civilisation, the following passage occurs: 'In the breeding of domestic animals, the elimination of those individuals, though few in number, which are in any marked manner inferior, is by no means an unimportant element towards success. This especially holds good with injurious characters, which tend to re-appear through reversion, such as blackness in sheep; and with mankind some of the worst dispositions, which occasionally, without any assignable cause, make their appearance in families, may perhaps be reversions to a savage state, from which we are not removed by very many generations. This view seems, indeed, recognised in the common expression that such men are the black sheep of the family.'[2]

The example in animal life is well chosen, fitting in neatly with the analogy which popular language supplies. It is impossible to take this gravely. The familiar phraseology shows how readily we regard moral deterioration as tending to the level of the beasts. But, as we have said in stating the facts to be explained, human degradation is much below any

[1] *Descent of Man*, p. 137. [2] *Ib.* p. 137.

thing that appears in animal life. Considering the quite guarded language employed by so high an authority in natural history, I do not here deal with his hypothesis that these distressing exceptional cases 'may perhaps be reversions to a savage state,' specially in view of the admission that they occur 'without any assignable cause.' On the other hand, bad dispositions in men have no analogy with blackness of wool in sheep. The example chosen, under obvious allurement of current phraseology as to 'black sheep,' proves to be one of the least effective. Black wool can count for no more than grey hair appearing early in some cases, an appearance which has little organic relation with mental dispositions. Grey hairs do, indeed, not infrequently occur in human life, as a *consequence* of deep and long-continued grief; but this does not happen to be an 'assignable cause' for occasional appearances of black wool.

The contrast between man and sheep thus becomes suggestive of a marked difference in the conditions of the two lives. So much is this recognised by all, that treatment in the two cases becomes public testimony for the contrast we are insisting on between animal life and rational. Tested by deterioration as it appears in the two cases, all animal life is placed on one side, including even the animal life of man himself; all rational life is placed on the other side.

In watching over any class of animals, when attention is directed to colour of wool or of hair, length of tail, formation of the head or limbs, length of body in contrast with compactness of a well-knit frame, the whole range of observations is concerned with organic life. They guide selection of stock, in accordance

with recognised laws of heredity. Physical differences appear in the human family in like manner, according to parentage. There is more than analogy here; it is a case of homology. Yet there is no one who suggests that the human family is on this account to be treated like the animals. We have had such dreams; they have even come down to us from an age prior to the Christian era, a product of Greek thought, in the midst of its own grievous perplexities. 'Eutopian' is the most gentle and merciful criticism in dealing with them. We have our statistics from domestication in abundance; we have in like manner our statistics of juvenile crime, with traces of inheritance. Our treatment of these two sets of figures shows how naturally, and with what force of reason, we distinguish between them. We recognise that the first applies to organism alone; that the second applies to a life in which mind and body are united, therefore we attempt to eradicate the evil. In the animal, inheritance is fixed, eradication is impossible, so that the rule must be to sell stock, and to buy in fresh stock. In the other case we neither shut up the young criminal, nor send him beyond the seas, nor execute him, but send him to a reformatory school, in hope of bringing him back to an honourable place in society. This is our witness to our recognition of two natures in one life. The results of our juvenile reformatory system prove the accuracy of our view. Such an illustration will suffice to show that deterioration signifies two quite distinct things, as it appears in animal life or in human; always remembering that animal life is included within the human, and may involve physical taint for human organism, as for the sheep.

The facts to which our thought is now being directed have received special attention from Professor E. Ray Lankester, whose discussion deserves consideration. 'Degeneration: A Chapter in Darwinism' is the title of the lecture which appears first in his volume of Essays.[1] At the outset, the references are to organic variations, and are virtually inapplicable to human life so far as it is rational. Professor Lankester's observations are designed to show that 'the process of natural selection and survival of the fittest' has not 'inevitably acted so as either to improve and elaborate the structure of all the organisms subject to it, or else has left them unchanged, exactly fitted to their conditions, maintained, as it were, in a state of balance.'[2] On the contrary he argues, 'we have as possibilities either balance, or elaboration, or degeneration.'[3] The reader will remark how naturally the whole range of observation is taken as one of 'structure,' and the reference is made to 'all the organisms.' Nevertheless, before the close, it appears that this is preparatory to showing that 'the traditional history of mankind furnishes us with notable examples of degeneration.'[4] We are here specially concerned with these notable examples.

The illustrations of degeneration first given are those supplied by lizards and by parasites. The former set of illustrations will suffice here. Our author says, 'I may call to mind the very remarkable series of lizard-like animals which exist in the south of Europe and in other countries, which exhibit in closely-related

[1] *The Advancement of Science*: Occasional Essays and Addresses, 1890.

[2] *Ib.* p. 22. [3] *Ib.* p. 24. [4] *Ib.* p. 47.

genera a gradual loss of the limbs—a local or limited degeneration. We have the common lizard (*Lacerta*) with five toes on each of its well-grown fore and hind limbs; then we have side by side with this a lizard-like creature, *Seps*, in which both pairs of limbs have become ridiculously small, and are evidently ceasing to be useful in the way in which those of *Lacerta* are useful; and lastly, we have *Bipes*, in which the anterior pair of limbs has altogether vanished, and only a pair of stumps, representing the hinder limbs, remain. No naturalist doubts that *Seps* and *Bipes* represent two stages of degeneration, or atrophy of the limbs.'[1] This is a 'very partial or local atrophy,' which may help to illustrate degeneration as that may apply to the whole organism. 'Degeneration may be defined as a gradual change of the structure in which the organism becomes adapted to less varied and less complex conditions of life.'[2] 'Any new set of conditions occurring to an animal which render its food and safety very easily attained, seem to lead as a rule to degeneration: just as an active healthy man sometimes degenerates when he becomes suddenly possessed of a fortune, or as Rome degenerated when possessed of the riches of the ancient world.'[3]

That both men and animals are liable to degenerate is certain; that man is the better for being constrained to work in order to obtain food, just as an animal is, must be no less clear; but we have to inquire whether there is here such analogy as to bring the cases of degeneration under common laws. For this purpose, we shall proceed to that part of the discussion directly concerned with human life.

[1] *Advancement of Science*, p. 26. [2] *Ib.* p. 26. [3] *Ib.* p. 27.

The facts admitted are these. 'High states of civilisation have decayed and given place to low and degenerate states:' 'many savage races, as we at present see them, are actually degenerate and are descended from ancestors possessed of a relatively elaborate civilisation;' as such 'we may cite some of the Indians of Central America, the modern Egyptians, and even the heirs of the great Oriental monarchies of præ-Christian times;' 'degeneration has a very large share in the explanation of the condition of the most barbarous races, such as the Fuegians, the Bushmen, and even the Australians; they exhibit evidence of being descended from ancestors more cultivated than themselves.'[1] The testimony for these positions will be accepted as sufficient.

In the midst of this discussion, Professor Lankester introduces references to the race as a whole, the accuracy of which seems doubtful, in view of the statements just quoted. He says, 'At one time, it was a favourite doctrine that the savage races of mankind were degenerate descendants of the higher and civilised races. This general and sweeping application of the doctrine of degeneration has been proved to be erroneous by careful study of the habits, arts, and beliefs of savages.' Hence he concludes that 'the hypothesis of universal degeneration as an explanation of savage races has been justly discarded.' We are here directly concerned with degeneration in animals and in man as illustrated before our eyes. But it is difficult to see how these two statements hold a place in the heart of such sentences as have been quoted. If man can degenerate; if there are examples of de-

[1] *Advancement of Science*, p. 47.

generation in tribes now existing; if evidence of degeneration is spread so very widely over the world as these references imply, there does not seem solid basis for an argument against degeneration in the history of the race as a whole, unless there be some law to prevent this calamity becoming general; and it does not seem alleged that there is such a law.

The hypothesis that degeneration has not touched the whole race lives in hazardous surroundings. It may, however, escape atrophy,—it may even thrive,—by fighting for existence. The dangers are serious, however. If we consider how 'the great Oriental monarchies of præ-Christian times' have gone; how 'Rome degenerated when possessed of the riches of the ancient world;' how 'the immediate forefathers of our civilisation, the ancient Greeks,' disappeared from the place of eminence, the hypothesis of a favoured portion of the race having escaped a disaster so common, does not seem to have a large reserved force to bring up. Professor Lankester wisely aims at giving his countrymen warning of danger. Hence he says, 'it is well to remember that we are subject to the general laws of evolution, and are as likely to degenerate as to progress.'[1] Does this not seem to suggest that all are exposed to the risk, and that it is therefore possible, under natural law, that all may have suffered? Suppose, then, that we turn in the other direction. Things do not look much better here. For if 'degeneration has a very large share in the explanation of the condition of the most barbarous races,' is it probable that in very ancient times, there may have been races worse than these? If this seem

[1] *Advancement of Science*, p. 48.

improbable, 'the explanation of the condition' then, may be as the explanation of the condition now. Let us, then, next turn to 'our modern civilisation.' What have we to say of this? Our author has strong testimony to give. 'Are all the inventions and figments of human superstition and folly, the self-inflicted torturing of mind, the reiterated substitution of wrong for right, and of falsehood for truth, which disfigure our modern civilisation, are these evidences of progress? In such respects we have at least reason to fear that we may be degenerate.'[1] This passage, strong as it is, does not seem too strong, in view of the facts to be found in the midst of our modern civilisation. But, this granted, two things seem involved, that progress of the race fights against heavy odds even in our modern civilisation; and that, as degeneration appears under natural law, the hypothesis that some portion of our race has escaped, appears highly improbable.

Our main question, however, is quite aside from historic hypothesis. We look at the facts of degeneration as these lie open to observation. They point clearly to two distinct phases of degeneracy, in accordance with the distinction between animal and man, and also with the distinction between animal and mind, in man himself. It does not seem needful to travel wider than the testimony supplied above. Professor Lankester does not propose to deal with degeneration in animals otherwise than as a fact to be admitted as inevitable under natural law. But he reasons with his fellow-countrymen, warning them of a danger to be dreaded and avoided. This aptly

[1] *Advancement of Science*, p. 48.

illustrates the difference. He speaks directly to our rational nature. He assumes a special power within us, implying a marked contrast in the aspects of natural law. That he emphasises this contrast, it is not possible to claim; but what is said is admirably said, and so concisely, as exactly to serve our purpose here: 'It is possible for us—just as the ascidian throws away its tail and its eye, and sinks into a quiescent state of inferiority—to reject the good gift of reason with which every child is born, and to degenerate into a contented life of material enjoyment, accompanied by ignorance and superstition.'[1] The language is in every part expressive; the analogy is a failure. It is, indeed, possible for degeneration to happen in the life of man, as it is possible for the larvial ascidian to lose his tail. But the analogy is so faulty that the illustration gives vividness to the contrast of the animal and the rational life. The tail is not to the tadpole what 'the good gift of reason' is to man. When the tadpole 'drops his tail,' he cannot resume it, or have its guiding help more; when man rejects 'the good gift,' he does not drop it; he continues to use it in some manner; and, though it is either in abeyance, or is greatly misdirected, he can resume its larger use, realising that the power is still a part of himself, is indeed his 'better-self,' so that when he reforms, and begins to act more rationally, we say he has 'come to himself.' We can wish no better proof of the contrast between man and animal than science offers here.

When we reason with our fellows, or with ourselves, against yielding to degeneration, our words show

[1] *Advancement of Science*, p. 49.

that man is in possession of a nature shared by no animal. With 'the good gift of reason,' as is here said, 'every child is born;' 'to *reject*' this good gift is a man's own conscious and responsible act, not occurring by force of natural law, as when the sheep shows a breadth of black wool; not an effect of heredity purely, even though 'inheritance' may have something to do with it; but involving deliberate, continued, responsible action, throughout the history of which, even down to the lowest degeneration, the man never parts with his reason, though not infrequently he parts with his hope.

In carrying forward this argument, I have been careful to introduce, from time to time, reference to the animal nature of man. This is at once an obvious part of the theoretic position here maintained, and is quite essential for the present stage in the discussion. Thus it is made increasingly obvious, that it is only on recognition of two natures,—two orders of life,—animal and rational, in man, that an adequate representation of 'degeneration' and of personal responsibility can be founded, or any true reading of heredity, as it appears in human life. To the bearings of heredity in a life, at once animal and rational, it becomes desirable now to give deliberate consideration.

Only by keeping the physical distinct from the mental in the life of man, and, at the same time, only by keeping full in view the unity of the life, in which these two are constituents, is a doctrine of heredity in human life attainable, in such a form as can be generally accepted. That there are conditions other than those of animal life, appears from our admission of responsibility. Man is so much more than

animal, that the laws of heredity applicable to animal life, and to his animal life, exactly as to any other, prove inadequate, and in some senses inapplicable, when their transference to human life as a whole is attempted. We shall first seek to trace the application of physical laws to the fullest extent; and shall thus seek to show where and when their limits of application are reached.

The physical nature of man comes within sweep of the laws of heredity applicable to all organism. This is scientifically the most obvious position, and, on this account, it has the smallest number of scientific perplexities attached. The development of the organic life in man, from the fertilisation of the egg onwards, takes place under conditions analogous with the development of all organism. There is in each case 'the fusion of two hereditary tendencies,' showing themselves clearly after birth. The persistence of physical inheritance is manifest in every family of the race. A vigorous parentage gives a vigorous family: a feeble parentage the reverse. Disregard of conditions of health will spread an enfeebled life to the succeeding generation. Crowding of population in the great centres, life in an exhausted atmosphere, work in cramped or constrained position, and circulation through the atmosphere of deleterious matter, inevitably lower physical vigour, which must tell on the physique of the population. An active life, spent largely in the open air, with advantages otherwise from residence in rural districts, will show opposite results, notwithstanding disadvantages from restricted quantity, and little variety, of food. The laws of heredity carry forward these results.

Beyond these general aspects of physical heredity in human history, there are the numerous and painful illustrations of hereditary disease. If an enfeebled constitution is liable to malady, if it gives lodgment to the seeds of disease, it is impossible that the germ-plasm should escape contamination. If we grant the 'fusion of two hereditary tendencies' in every fertilised ovum, this hereditary result is inevitable. The human race, notwithstanding its elevation in the scale, notwithstanding all the effective things written by evolutionists as to 'the flower of the ages,' has not been exempted, even in the smallest degree, from the laws of heredity applicable to organism.[1] The physique of the parents, whether high or low, must tell on the children. The law of inheritance is as truly fixed law, as any other law of physical existence. The facts, even the most painful which social life presents, must be regarded and interpreted as facts concerned with organic life. The conclusions of ordinary observers, and of specialists, concur in support of this position.

But it is obviously impossible to end our study of the subject thus. We have before us abundant evidence for the distinctness of two natures in man. What, then, do we mean by *responsibility* in human life? We never speak of it in the case of the animals, when we note long tails, or a tail falling away, or when we remark on shortened legs, or atrophy among the lizards of southern Europe. Yet we never fail to speak of responsibility in human life. Our medical advisers are, of all men, the most clear and explicit here. This is their testimony to a two-fold nature

[1] On Phenomena of Disease, see Darwin's *Descent of Man*, p. 7.

in man. In attributing responsibility, we affirm the presence of rationality, and the obligation it involves. We acknowledge power to see and appreciate the right, to recognise its bearing, and to regulate conduct in accordance with such knowledge. These are the conditions on which the appeals of our medical advisers rest. Such appeals would be irrational and unscientific, if specialists were dealing only with an organic life. The duality of human life is admitted —cannot be obscured—if specialists advise their patients, expecting their advice to be followed.

Responsibility for our physical condition being granted, what is the full range of its meaning; what are its limitations? It is impossible to answer without adding to the testimony for duality in human life. Whether you will or no, two sets of phrases come into use; distinct spheres of application are found for them. We speak of 'laws of health' as fixed, and simply to be obeyed; we speak of personal resolution, as that which must be formed by each individual for himself, and must be carried out by himself, whatever inducements he may have to act differently. We all know the formulæ of the consulting-room, or of the hospital ward; and we know how much dependence must be placed on the integrity of the patient. The diagnosis may be correct; the prescription may be good; but what if the patient place it on the shelf? Where is responsibility then?

What is here brought to a narrow point, applies throughout the whole intricate entanglements of our self-directed activity. The law of heredity has its reading in human history in accordance with this duality in human life. This is only one of the many

phases of the speciality of a rational life. It is, indeed, an idle dream to suppose that human liberty can escape the dominion of physical law. It is, on the other hand, an animating conclusion from scientific inductions, that rational control of physical impulses will bring large physical gain. The explanation is that the life, rational and animal, is one; that the laws of organism are fixed; and that the government of reason, in accordance with these known laws of health, is matter of experience.

The measurement of parental responsibility is likewise found in the relations of rationality to ascertained hereditary conditions. Laws of organic descent are fixed; the rational agent can understand them, and can regulate his conduct accordingly. The full meaning of this, needs to be more exactly expressed, and more widely understood. Only in this way, can we escape dangers of 'degeneration,' appreciating and profiting by the warnings of the Faculty. Only by recognising, in every department of activity, the relation of rational guidance of conduct to the fixed law of physical existence, can man's place in Nature have appreciation, in a manner at once scientific and practical.

The limits of personal responsibility in relation to the fixedness of physical law may first engage attention. The contrast between the physical life and the rational, will thus appear more fully, and also the unity of the two forms of existence in one life. The sharpness of the distinction is readily marked. It is conspicuous in the contrast between the *risk* to which all life is exposed; and the *precautions* voluntarily taken for its preservation. This contrast places well within ordinary

observation the difference between natural law and rational direction of conduct; and it may lead with great sense of security towards reliable discrimination as to the wider bearings of heredity in the history of man. For the risks we are not responsible; for the precautions all are responsible.

Responsibility connected with knowledge of the laws of heredity, rests on the parents; no part of this responsibility extends to offspring. Much importance belongs to both sides of this statement. The responsibilities of parents are large. Their children's deepest interests are involved in parental regard to these. The child unborn will have its future decided by the character of the stock from which it springs. There is no law more severe. Physical health cared for and cultivated by young men and by young women, as if it were purely a thing of personal interest; physical health guarded by husband and wife, as if each were but guarding the other's good, and sharing in the joy of it, supply the surest provision for the physical gain of their descendants. Feebleness may be transmitted, for which grave responsibility belongs to the parents. Thus, vigour of offspring may depend on rate of increase within family history. A mother's strength abated, will give a younger child a feebler frame, than an earlier child has inherited. Parents burdened with grief may extend depression into the life of descendants. There are wider reasons for self-command in times of sorrow, than those of personal consolation. There is no more serious aspect of responsibility than that which is traced here as incidental to parentage. It deserves to be more pondered than it has been. If there be anything more serious still, it is connected

with the possibility of transmitting nerve-sensibility in matters of taste, as in the case of 'alcoholism.' What is considered as a thing of mere personal gratification, cannot be so regarded, if it be possible to transmit a tainted, or even abnormally excited nerve-condition. That this is possible, is one of the most clearly established facts in the record of inherited disorder.[1] Of the physical evils which can be transmitted, deteriorated nerve-system is alarming to contemplate, touching closely on momentous questions in morals and in national history. Dr. Clouston says 'use of alcohol is unfortunately the most common of all the causes of insanity.' It is a 'general cause of all kinds' of the disease; and if attention be concentrated on cases in Britain in which it is directly the cause of insanity in the individual life itself, 'from 15 to 20 per cent. of the cases of mental disease may, taking the country through, be put down to alcohol as a cause, wholly or in part.'[2] Responsibility for such evil, and for transmission of taint, depends on the powers of reflection and self-regulation, possessed by man, in view of ascertained results of indulgence.

Now we pass to the larger and still more urgent question, introducing the whole range of moral life. Thus only can we complete the discussion of 'inheritance.' Previous discussions are merely preliminary and preparatory to more extended application.

Each child born has its own distinct life-heritage. No two moral agents start the race of life on precisely the same terms. Each successive life, even in the

[1] On this subject, full of importance to society, see *Lectures on Mental Diseases*, by T. S. Clouston, M.D., Lecturer in Edinburgh University.

[2] *Ibid.* p. 436.

same family, has a distinct heritage, determined by varying conditions in embryological life. The common inheritance is there,—'the good gift of reason.' Within the family circle, there is the common family training, not always equal to all concerned, unfortunately. Within the distinctive inheritance of each, the characteristics of nerve-sensibility most seriously determine the demands on self-control to be made in after-life. Here are most important considerations. Responsibility does not begin when life begins; and, when it arises, it does not include responsibility for the life-struggle entailed by the type of individuality inherited. Responsibility for transmitting the inheritance cannot be transmitted. Whatever the mysteries of heredity, they do not include an increase of responsibility for the inheritor. What holds as to inheritance of wealth, does not hold as to what is more strictly 'personal inheritance.' Common responsibility begins with appearance of common inheritance, in the activity of reason. Special responsibility for each, begins with the struggle to master his individuality under the conditions belonging to his life. Consider how slowly a child comes to the consciousness of his own life-task, and you will see the responsibility of parents and educationists in training. How much they owe to the individual life depending on their leading; how much to the nation, that these may be good citizens! When we come to manhood, or to womanhood, the burden must be taken on our own shoulders. We are rational. On each member of our race it devolves to cultivate and use the effective power of his life; to battle with the evil which can be conquered; to bear bravely the evil

which must be endured, bringing gain out of endurance. There is not space for dwelling on this wide range of action. Our main interest here centres on 'the evil inheritance,' and on personal relation to that. Here, where things look darkest, the distinctiveness of rational powers is apparent. This is a power not within the area of the physical, but capable of controlling it, so as even, in some degree, to modify it, by success of rational effort, sustained from day to day. Interpretation of rational power, and of its laws, shows that human life, even at its worst, is never so low as animal life, even when in all visible aspects it seems lower. There is more hope of a profligate, than of the vicious animal. Place full in view the saddest results of heredity, and however bad the case, the man is not doomed. He has the power to see the evil, the power to separate it from what he regards as his true self, the power to struggle against it, the power to gain the mastery, even if it be through sore battle, with bitter sense of pain and peril, waged bravely during a long and very weary campaign.

There are people to whom this description of moral conflict in its physical relations will read as exaggeration. Fortunate people! And truly fortunate race also, even when facing its darkest social problems, for the worst types of inheritance are not the common; and the worst are not hopeless. The history of progress is carrying an ever increasing number of the race to a more favourable starting-point. The lamp of religion has cheered the most desperate, whose children's children have opened their eyes on scenes more hopeful, with only a thin shadow of an ancestor's sorrow,

to tell how large a victory had been achieved. Those who have prevailed over the dangers of an evil inheritance, are victorious in life, having done not a little to deliver others from an evil taint, and from sore struggle. The 'black-sheep' theory is inapplicable. It is at fault on both sides. It maligns the sheep, and it does not explain the man. Even when attention is turned on the lowest levels of human degeneration, the power of a rational life is undestroyed. The physical life may be hopelessly enfeebled; profligacy may disclose Nature's penalty in the paralysis of manly vigour; but the best in man is not utterly laid waste; the penitent's hope is not debarred. Most bitter of thoughts in the recoil from degradation, is the thought that the consequences are not concentrated in one's own experience, and are not closed with it. Even one's children may carry the taint, facing sore life-conflict as the result of conduct in which they had no part. They suffer because their parents did not act a better part. But thought, and fight, and freedom, are still possible to these belated ones. The greatness of our Christianity appears in this, that it meets those who are worst stricken, bringing them hope and help from God, merciful and gracious, of whom we ever say—'Shall not the Judge of all the earth do right?'

The reading of heredity, as thus interpreted in relation to human life, must have its bearing on human destiny. Even a wasted life may be a sacred life; the body wrecked, the man delivered. This, however, reckons at best only as some mitigation of the burden we bear, when the darkest side of human life is considered. We are deeply concerned in the outcome of

this inquiry, as heredity bears on thought concerning a future state. A wasted organism is in any case a saddening sight; but all organism is doomed to decay. Death is as constant in its appearance as Life. It makes an immense difference, however, for the history of a human life, whether the body is worn out by vice, or has had its resources exhausted by virtuous labour. Physical results in these cases bear witness to things spiritual, bad and good, telling of the character of the inner life, which is truly the life itself. For we are 'dealing not with the outward man, but with the inward, which is the true self and concernment of a man.'[1] Though all life ends in death, in the case of each human life, the character of this end is to be judged by the moral standard which has been the test of conduct throughout its course. 'So far as a man is true to virtue, to veracity and justice, to equity and charity, and the right of the case, in whatever he is concerned, so far he is on the side of the Divine administration and co-operates with it.'[2] It is this truth which has ruled human thought concerning the Future. All see rewards and penalties in the present; we expect them in the future state. Our inference is drawn from 'the present order of things,' from 'the course itself of events, which lies open to every one's inquiry and examination.' We contemplate Conscience with its testimony for the ideal; self-criticism with its praise and blame of our own conduct; indignation with evil doers who inflict wrong on their fellows; and the force of moral sentiment,—the persistence of moral feeling, —that 'internal sense or feeling, which,' Hume says,

[1] Plato's *Republic*, Book iv. p. 443, Jowett's Translation.
[2] Butler's *Analogy*, Pt. I. chap. iii.

'Nature has made universal in the whole species:'[1] 'Reasoning from the common course of Nature, and without supposing any new intervention of the Supreme Cause,'[2] it is clear that the government of the world deals with distinctions between right and wrong as fixed distinctions. Rewards and penalties are distributed accordingly. The worst penalties, as the best rewards, belong not to the body, but to the mind. Penalty and reward appear in the continuity of the life-experience. Hence we conclude that moral law is the expression of the Divine will, and that 'judgment to come' is a natural sequence to the present order. Under force of this conviction it is, that we are constrained to deal with the deeper ethical problems connected with interpretation of the laws of heredity, as these bear on human destiny. If moral distinctions are the ultimate test of life; if virtue and vice are placed in vivid contrast in the present order of things; how, then, shall it be as to judgment, in view of the amazing differences of inheritance with which men start? The question is one of deep and painful interest. The answer is to be sought with utmost deliberation, from readings of the laws of government in the present order. In anticipation of such a stupendous event as a final award on the outcome of human life, it is safe to maintain the reserve of Hume's canon, just quoted, to 'reason from the common course of Nature, and without supposing any new intervention of the Supreme Cause, which ought always to be excluded from philosophy.' Even thus, our ethical

[1] *Inquiry concerning the Principles of Morals*, Section I. Green's ed. of *The Essays*, vol. ii. p. 172.

[2] *Ibid.* ii. p. 400.

conclusions seem clear and definite. If ethical distinctions are fixed in the order of Nature, judgment hereafter will proceed upon these distinctions, as they are recognised in the present. If the life be continuous, so must be the consequences of its own action, which has given fixedness to character, and has extended its results into the history of succeeding generations. But, on the other hand, it seems manifest that the law of heredity does not throw a deep and long shadow into the life beyond; rather it seems to follow from the facts of the present order, that there shall be such limits of judgment hereafter, as there are limits of responsibility here. 'It shall be required of a man according to that he hath.' Judgment is measured by responsibility, and responsibility includes no more than belongs to personal choice. A man's actions are his own; for these only can he be commended or condemned. Hence, judgment of life by moral distinctions visible all through its course, is such judgment as lies recorded *in personal conduct.* Judgment of our actions is not a thing of weights and measures, however naturally we introduce the analogy, 'weighed in the balances, and found wanting.' If there is truth in this analogy, as there is, it lies behind the symbol; judgment was already fixed when we weighed, and selected, and determined the course of our own action. Short of this, there is no responsibility. Where dawning rationality appears, responsibility begins. This is continually affirmed in our judgments of our fellows. All this belongs to ordinary ethical thought. It is implied in the awards of praise and blame we are daily recording, as we judge ourselves and others. The tests of a man are

conduct and character. The demand upon every man is for righteousness: his ultimate destiny, under Divine guidance and favour, as illustrated in the present order, is a perfect righteousness. The religion of Jesus Christ meets the demands of ethical life, and the deepest longings of the soul. Progress is the law of the universe; moral progress the law of human life. Advance is ever the rule, even while the two orders of laws, under which human life acts, are altogether different in nature. Physical law differs from ethical. Thus all men are placed under common obligations, in view of the one grand ideal of a moral life. But when the difference of start is considered—when the consequences of heredity are included within our survey—how different must be the history of moral progress on the earth; how different the judgments of its varying phases! The moral life is rationally required to work towards realisation of its own ideal; but this can be done only in facing conditions of existence, under which each life-history must be distinct. In the eyes of the Moral Governor of us all, a small advance in the battle against an evil inheritance, seeming to us even more of failure than of advance, may count for more in the sphere of effort, than an intrinsically better activity in the life of one for whom moral progress seems natural and easy, or comes to be so. When our Lord said, 'It shall be more tolerable for the heathen in the day of judgment, than for you,' He implied that future judgment shall be rigidly according to the conditions of each life, with all its difficulties full in view. As the struggle of the battle-field is the key to an army's victorious march; the turning-point in human life, is the battle for moral

freedom. Our life does not quickly clear itself from such analogies as military conflict supplies. As is the contrast between allurements to evil, and attraction towards the good; so is the contrast between victory in strife, and quiet achievements in the silent progress of a life which is moving with accelerated force towards maturity.

Within such brief compass as this, must be included our treatment of the darker side of human life. Degeneration, as it appears in the life of man, is the worst to be witnessed on the earth; it is altogether singular in its character and depth; and it is apparent everywhere in the world, nowhere more distressingly than in the heart of modern civilisation. Yet, this degeneration does not conceal, does not even obscure, the characteristics of the rational life; but, in a quite vivid and striking way, supplies its own quota of evidence for the distinction between the life of organism, and the life of the moral agent.

After this discussion of degeneration, we resume consideration of the normal activity of rational life, as this appears in the ordinary guidance of conduct by ethical thought. The contrast between animal life and human becomes increasingly conspicuous as we proceed. The search of the animal is for his food. This is the full meaning of 'the struggle for existence,' as illustrated in organic evolution. The work of man only *begins* with hunger's craving. So it must begin, however, for it is for man, as for the beast of the field, a stern necessity that the demands of the physical life be met. So pressing are these, that we are apt to speak of them as the 'demands of Nature.' From encounter with these, there is no escape. But the work

of man expands, as the range of knowledge and of intelligent interest widens. Food is not the end of his effort. If the animal lives to eat, he eats in order to live; he even finds life's work in passing from his meals. Ever as life advances, work carries within it life's grandest interests. What is even more than this, work becomes a law for man's life, not by the constraint of a physical necessity, but by the higher constraint of rational law. Industry becomes life's distinction. To the rational agent it seems clear, ever clearer as he works on, and reflects more patiently, seeking companionship with wisdom in his daily pursuits—that the law of his existence is the full use of his powers.

> 'Sure, He that made us with such large discourse,
> Looking before and after, gave us not
> That capability and godlike reason
> To fust in us unused.'[1]

The duty and dignity of work are manifest. Carlyle found ready assent for his preaching of the gospel of work. The people had always recognised it. They hailed his teaching, because his words had force akin to the energy of life itself. Everywhere in human life, it is rational law, not physical, which is pre-eminent. Let the law of justice stand for symbol here. This is a law whose authority finds acknowledgment everywhere; in rougher fashion, where primitive conditions of social life prevail; in more formal manner, where constitutional law reigns. This is a law which finds homage in popular assemblies; and makes a single man strong against intrigue, if only violence is restrained. This is a law which changes

[1] *Hamlet*, Act IV. Sc. 4.

the whole aspects of life—turning to condemnation animal struggle for existence, disregarding, or trampling under foot, the strivings of those weaker and less favoured. It is a law which breaks the line of Evolution, as it marks the limits of organic action, symbol of muscular force and animal passion, which by contrast we call 'brute force.' This is a law which shows the distinction of the human race, placing within every life the title to personal rights, and constituting every man agent in the executive of the moral government, which predominates in the present order of things. This is a law by application of which human rights have been rescued from the cruel hand of oppression. This is a law which, in the course of the centuries, has ended autocratic dominion, has broken up the feudal system, and has prepared the way for acknowledgment of the common rights of humanity, with the common responsibilities of rulers and subjects.

It is only natural that man so placed—so working under rational law—so guided by light of reason—so warranted to be judge at once of himself and of other agents placed with him under 'common law,' so appointed to be a guardian of all life's highest interests, including the interests of all the animals around him, should above and beyond Nature, recognise the Supernatural. These two are rationally conjoined. There is no morality without law; no law without government; no share in work and administration, without share in pains and penalties; and no fixed order without Supreme Power, personally sustaining moral order. It is all clear enough. The whole human race has seen it, more or less plainly. Hence the Religions of the world. These, however they may differ, tell us of

the world's thought. They express it confusedly, when knowledge is small, and intelligence travels back and forward on narrow and short tracks. They express it more adequately, when thought, having cleared itself from superstition, has reached a better and fuller knowledge of the laws of existence, so attaining to the possibility of 'reasoning from the common course of Nature.' They express it more purely, when the dominion of rational law, higher than physical, has been more fully recognised; when the claims of humanity are more clearly and steadily owned; when the sweep of moral sentiment supplies quick and warm support for well-doing. None of these Religions expresses the grand and noble truth otherwise than inadequately. Human intelligence cannot outstretch its own bounds. Yet this is a most striking testimony to its vast power, that it knows that the First Cause exceeds all human representation of His essential greatness. Spirits the clearest, the purest, the noblest on earth, know this inadequacy of expression of religious truth, whether clothed in feeble language, or illustrated bravely in deeds of noble consecration, or formally represented in creeds and organisations. Even the dullest and the worst of men perceive when the representation is worthy, and when unworthy. The world is getting to know that all Religions at heart are one, and are to be so regarded and treated. In all of them, man is feeling after the resting-place of a rational belief; seeking after the Supreme; doing homage to the Eternal; knowing and feeling the inadequacy of all that is known and done; yet anticipating a destiny exalted above all that is known. In these investigations, we are chiefly attracted and

absorbed by the unity of religious thought, as a manifestation of rational life, holding a prominent place in universal history. But, among the religions of the world, comparison becomes as needful in our estimate of general history, as it has been seen to be when dealing with the various forms of life on the earth. The sense of this has given volume and value to the stream of modern thought concerned with Comparative Religion. The historic spirit, borne on the surface of the strong current of scientific thought, has carried interest, philological, literary, and philosophical, back upon the earliest phases of religious thought. To modern thinkers Brahmanism, and Buddhism, the teaching of Zoroaster and the doctrine of Confucius, Mohammedanism and Christianity, have together supplied material for research and reflection.[1] To more general observers, chiefly concerned with the moulding and marshalling of political forces in modern times, and with the manifest expansiveness of rational power, it has become subject of remark how the Crescent is waning before the Cross. A vast mass of materials thus placed at command, has special value for interpretation of the unfolding of human thought. Towards exposition of this, large service has already been rendered by competent scholars, and much more remains to be done, within

[1] *The Sacred Books of the East*, translated by various Oriental scholars, edited by Max Müller. *Vedic Hymns* by Max Müller, 1891. Legge's *Sacred Books of China*. *The Texts of Confucianism*, 1882. *The Texts of Tâoism*, Legge, 1891. *Metrical Translations from Sanskrit Writers*, by Dr. John Muir, 1879. *Chinese Buddhism*, by Dr. Edkins, 1880. Haug's *Essays on the Sacred Language, Writings, and Religions of the Parsis*, 1878. Sir William Muir's *Life of Mahomet, and History of Islam*, 4 vols. 1877.

lines only recently opened up. The Christian nations hold the commanding positions in the world, so that it is impossible to regard the others as offering any serious competition with them for ascendancy, in moulding the world's future.

In dealing with man's place in Nature, the lines of investigation do not include any examination of Christianity as a supernatural religion, but only as a spiritual force contributing to the advance of the race. We contemplate it here as a historic religion, whose faith in the Supreme, whose conceptions of life, whose motives for action, whose views of future existence, have wielded a mighty influence in course of the ages. Our stand-point is essentially that occupied by the historian, whose position is distinct from that of the theologian. Gibbon has fitly expressed the difference between these two points of view. 'The theologian may indulge the pleasing task of describing religion as she descended from heaven, arrayed in her native purity. A more melancholy duty is imposed on the historian. He must discover the inevitable mixture of error and corruption, which she contracted in a long residence on the earth, among a weak and degenerate race of beings.'[1] But Christ stands out distinct from the Christianity which has had a place in the world ever since His coming. The Christ of history is a unique personality; one whose character is a singular embodiment of human excellence; one whose appearance in the world, it is impossible to explain within the terms of evolution. Two things stand out clearly, when His life is set in contrast with other lives: His superiority to the age in which He lived, and the

[1] *Decline and Fall of the Roman Empire*, vol. ii. chap. xv. p. 262.

inferiority to Him of all His followers in all ages. The Christ of history cannot be regarded as the product of his age. His influence in the earth has not been that belonging to worldly dominion, or to political power; it has been a spiritual influence, extending by the force of ideas, and by the agency of a moral and religious inspiration. Christ has received, at once, the most intelligent, and the most devout homage of men, of which history bears record. Around His name and life have gathered the most searching, uncompromising, and antagonistic criticisms that have ever risen against any leader of men. Such criticism has been hailed by a large constituency. Even now, when Christianity has powerful sway in society, we must admit the truth of J. S. Mill's statement,—'The world would be astonished if it knew how great a proportion of its brightest ornaments—of those most distinguished even in popular estimation for wisdom and virtue, are complete sceptics in religion.'[1] The statement is true in both particulars,—as to the scepticism which exists, and as to the astonishment which would be awakened were it fully known. The one is the counterpoise of the other, presenting a remarkable antithesis in human opinion as to the value of religion. This testimony as to prevailing unbelief comes from an author who says of himself,—'I am one of the very few examples, in this country, of one who has not thrown off religious belief, but never had it: I grew up in a negative state with regard to it.'[2] Many more than the sceptical have shared in sympathy with adverse criticism of Christianity. Conflicting sentiments beating against each other at the foot of

[1] *Autobiography*, p. 45. [2] *Ibid.* p. 43.

the Cross, bear, each in its own way, testimony for Christ, for which no adequate explanation can be found on natural grounds. The devotion to Christ is reasonable, only if He possessed the excellencies attributed to Him. If such excellencies were not His, why has His name not passed away; why has not criticism been abandoned as needless?

From conflict of opinion as to the Christ of history, we pass to results, to ask what witness Christianity has borne for itself. A great system of belief, expressing itself in vast organisations spread over the world, gives large range to criticism, and, at the same time, becomes more powerful in claiming a favourable verdict, as its history is prolonged. The influence of Christ's teaching is widely felt, specially in many great centres of modern civilisation, and from these it is radiating into all lands. If we glance over the centuries which make up the Christian era, testimony in its favour is seen in endlessly varying form. It has been a powerful agent in development of ethical and religious thought. Take the earliest historic period, when its practical power began to be felt throughout the Roman Empire: 'A pure and humble religion gently insinuated itself into the minds of men, grew up in silence and obscurity, derived new vigour from opposition, and finally erected the triumphant banner of the Cross on the ruins of the Capitol.'[1] Study the chequered history of Christianity through mediæval times, and all through these centuries its power can be traced in the upheaval of popular discontent against a sacerdotalism wanting the credentials of purity and lowliness; and

[1] Gibbon's *Decline and Fall of the Roman Empire*, vol. ii. chap. xv. p. 265.

in the outbreak of enthusiasm which answered to the appeal of Francis and of Dominic. Judged by its place in our modern civilisation, Christianity has this grand witness, that under its influence there have sprung into being manifold forms of benevolence, with which our modern age has grown familiar. Along with this, there has appeared in our century, an expansiveness of Christian zeal, the more striking that it has flourished in spite of conflict of opinion as to articles of faith, rivalry of organisations, jealousies among official representatives of the same organisation, and even an exclusiveness of spirit which has led the adherents of one Christian Church to unchristianise the adherents of another. If the historic testimony for Christianity is strong, it is not that the littlenesses and meannesses of human nature have not appeared within it, but that the power of Christianity has triumphed over them all. If thoroughly unprejudiced evidence be desired, it may be found in the testimony of John Stuart Mill, an honest and manly witness: 'Others besides Utilitarians have been of opinion that the Christian revelation was intended, and is fitted, to inform the hearts and minds of mankind with a spirit which should enable them to find for themselves what is right, and incline them to do it when found.'[1] This is the witness of one who did not wear the name of Christian; it is testimony from the heart of a man distinguished alike for honesty, and for a large spirit of benevolence. Strong as this evidence is, we cannot speak of Christianity as triumphant. The religions of the world, as all else existing in it, encounter 'the struggle for existence.' In the midst of this inevitable

[1] *Utilitarianism*, p. 32.

conflict, Christianity shows, of all the historic religions, largest promise of success in vindicating its claim to be the world's religion.

In this bare outline, I have sketched the religion of Christ, and the evidence from its wide dominion. It is the religion at once the most intellectual, and the most clear in testimony for a pure morality. Its wide acceptance in the world is in itself a striking witness for man's place in Nature, proving the existence of a faith giving large promise for the world's future, and at the same time a faith which sustains in the human soul an inspiring hope of greater good within the Kingdom of Heaven.

Over against Christianity, the best that can be placed by those who are sceptics in religion is Agnosticism, a witness for Ignorance. The strong testimony in its behalf, coming from the pen of Professor Huxley, deserves attention. He says, 'Wise men will probably agree to a verdict of "not proven" in respect of naturalistic theology, taking refuge in that Agnostic confession, which appears to me to be the only position for people who object to say that they know what they are quite aware they do not know.'[1] We can honour this position, in consideration of honour done to knowledge, even in that narrow sense which makes it depend on the instruments of observational science. But, there is no finality in it; it does not supply an adequate theory of knowledge. Search for causes cannot end where eyesight finds its limits, nor even where the inductions of observational science offer us sure footing. Outlook far beyond this, belongs to man. He

[1] Prologue to *Essays on some Controverted Questions*, by Thomas H. Huxley, F.R.S.

knows much beyond what observation has disclosed. To this, human life is constantly bearing witness. A single illustration may suffice, as presented in man's knowledge of ideal excellence, towards which moral life is striving, notwithstanding that no man sees this excellence presented in any example before him. Our place in Nature is such, that when we consider the whole range of organic life, and the position of human life in the midst of it; when we think of our conception of Duty, and of the service this conception has rendered in the battle for human progress, we must form, out of these materials, a representation of Nature as a whole. We must contemplate Nature as an orderly system, in the midst of which organic life of every specific type is tending towards the perfecting of its own form; while rational life is ever bearing witness, more or less clearly, even in the midst of individual degeneration, to an ideal of moral excellence. It is, however, too often true, that the significance of life's testimony can be read, only as it is written large over the penalties following upon human folly and wickedness.

Knowledge must be our guide; ignorance must be our warning, against dogmatic assertion, or security and slumber; reasoning our increasing exercise, in the spirit of inquiry and expectation. Agnosticism is unreasoning and unreal, if it be anything more than acknowledgment of the limit of our powers, whether they be powers of observation, of induction, of rational insight, or of 'scientific imagination.' Guided by Science, we are in possession of a more intimate knowledge of Nature than has ever before been at command of men. We are in this way, specially secured against

misinterpretation of the existing order. Guided further still by Science, we have come to recognise marvels all around us. In presence of these, our ignorance, vast and insuperable, must awaken within us reverence even for Nature itself, much more for the God of Nature, showing His power, and manifesting His will, in the fixed laws of the Universe. Recognising that the search for causes must result in acknowledgment of a beginning of the existing order, we are sustained by the whole breadth of scientific knowledge, in owning the First Cause as the Eternal, the Self-existent, the Infinite.

If, passing from the field of pure thought to the field of practice, we meet the tests supplied by human activity and experience, Christianity and Agnosticism are placed in contrast. When this is done, it is plain enough where the advantage lies. Agnosticism is a negation; in the realm of energy, a restraint, except as it leads to active and influential criticism; having otherwise no place among the world-forces telling in the history of human progress. Christianity is a living power, claiming to be judged by its fruits. It has inspired men with a lofty ideal; it has helped them in the struggle against sorrow and sin; it has inspired them with hope of immortality.

All inquiry, scientific and philosophic, must close by admitting the limits of knowledge; by granting that the mysteries of existence are many and great, transcending all powers of human understanding. With all the knowledge which the labours of science have stored up for us; with all the thought, analytic and synthetic, into which philosophy has conducted us; with full sense of the unique service

rendered to our race by Divine Revelation, we continue overawed by the vast range of unexplained existence. This testimony to Ignorance is the last witness of science; and to this there is yielded unanimous assent, the more ready in utterance, the more extended in significance, in proportion to the breadth of knowledge possessed by a man. 'Human existence is girt round with mystery: the narrow region of our experience is a small island in the midst of a boundless sea, which at once awes our feelings, and stimulates our imagination, by its vastness and its obscurity.'[1] A spirit, at once lowly and of large expectation, supplies fit index of the true excellence of a rational life. Newton, as he neared the close of his term on the earth, gave utterance to both feelings, as he said: 'I know not what I may appear to the world, but to myself I seem to have been only like a boy playing on the sea-shore, and diverting myself in, now and then, finding a smoother pebble or a prettier shell than ordinary, while the great ocean of truth lay all undiscovered before me.'[2] This is the utterance of a great thinker, of an instructor of the whole race, who is as a child in spirit, yet presenting the model of a lofty intellectual life.

Little more remains to be said, as we contemplate for a moment life's close, on coming towards the gates of death. Around this closing moment, all life's mysteries gather in most impressive forms. Nowhere does man more deeply feel how ignorant he is, how uncertain as to what the future may contain. This is a moment which must terminate our relations

[1] *Three Essays on Religion*, by J. S. Mill, p. 102.

[2] *Life of Newton*, by Sir David Brewster, vol. ii. p. 407.

with Nature; a moment when we shall take our first glance on a destiny implied in our moral life here. Faith and ignorance may then meet in undisturbed companionship; faith guiding through ignorance into a larger knowledge.

Here, on the confines of the Unseen, taking a last view of rational life in Nature, we are arrested by its distinctive characteristics, parting it from all life besides which the earth contains. What has been before our eyes at earlier stages of this inquiry, is recalled now, as bearing witness to the grandeur of human life. We have seen life multiplied lavishly, far beyond provision for its sustenance. We have seen 'the struggle for existence,' carrying much life onwards to inevitable destruction, while bearing stronger life forward to higher destiny. We have seen how higher life feeds on lower life, finding thus its own sustenance. But in rational life, though embodied in organism, and also subject to physical laws, in common with the beasts of the field, we perceive a check placed on destruction of life, by intervention of some higher and authoritative law, saying 'Thou shalt not kill.' Something still more impressive appears under application of this law, for men of all ranks and conditions have come to recognise that the rule here, makes human life 'sacred.' So, betimes in human history, when evil passion has inflicted fatal injury, death's name is changed to 'murder;' a single act of violence has made a man 'a criminal.' Is there not some vast difference of nature, which stamps human life 'sacred,' as no other life is? One other feature still is to be remarked, giving additional force to the impression made on us, for we see that in the form of moral

law, we come into relation with the sovereign *authority*, or *command* of the Ruler over all. Strange also, as we read out the writing telling of the government of Nature, appears the double relation of the rational life to law physical and law ethical. This bodily life of man is, in its relation to the forces of Nature, exposed to all the risks which assail the lowest organism, yet has the Ruler of all Himself interposed to provide for it a special defence. This witness for moral law we have in man's sense of solemn obligation. Everywhere on earth some acknowledgment of this appears. Violations of this moral law, as of all other law, there have been, and there continue to be, else how should we have had these names 'murder' and 'criminal,' bearing witness against iniquity, as they testify to the common convictions and sentiments of men? We cannot think lightly of the extent of murderous violence, nor underestimate the horror it awakens in those who have heard details of the cruelty involved. We cannot overlook in the world's history, the cannibalism which has existed among barbarians; the horrors of war, when wholesale destruction of human life has followed on clash of arms; the evil aspects of religious fanaticism, when a fatalistic belief has grasped the sword as the appointed instrument of destruction for the infidel; and, most hideous of all, the cases in which servants of Christ, himself the gentlest of men, most patient in judging, have resorted to the most horrible tortures as a means of bringing back to the faith those charged with heresy. All these things we read in history, notwithstanding the law which makes human life sacred. But all through these blackened, dreary records,

we find witness for the law itself, and testimony accordingly for the contrast between physical and rational life. We read this testimony in the cry for vengeance, when violence has brought destruction into the home: in the hatred of the tyrant whose power cannot be resisted; in the profession, most hideous even when honest, that the good of the soul is sought through means of the destruction of the body; most clearly in our modern condemnation of all injury, whatever the motives which have led on to deeds of violence, save where defensive warfare has lifted a strong hand for guard of human freedom, and for safety against threats of destruction. Yet in viewing wrongs such as those enumerated, chiefly the doing of them in name of religion, and under religious sanctions, we see reason for speaking of humanity as 'a weak and degenerate race of beings.' Counter testimony can, however, be raised for rational progress, when it is marked, that within all our modern civilisation there is formal acknowledgment of the sacredness of human life, and enforcement of its protection, under sanctions of the State.

When the depths of human thought and sentiment, out of which such formal acknowledgments arise, are sounded by us, it is found that with recognition of personal obligation and responsibility, there exists a belief that life's testing will be hereafter. We cannot, indeed, interpret the common *horror* with which murder is regarded, without reference to the cruel sufferings inflicted, and the accumlated sorrows beclouding the homes and the hearts of kindred; but we cannot interpret our conceptions of the *sacredness* of human life, without reference to belief in future

existence, and in the solemnities which must concentrate there. Towards such conclusions as these the great thinkers of ancient Greece reasoned. Socrates argued that 'there is good reason to hope that death is a good,' for either it is a sleep, and in that case 'eternity is only a single night,' or it is a pilgrimage to another world, in which are 'the sons of God who were righteous in their own life,' and whose judgment will be better than that of earthly judges.[1] Plato anticipated a future state, saying, when the dead arrive in the other world, 'they have sentence passed on them, as they have lived well and piously or not.' 'Wherefore let a man be of good cheer about his soul, . . . who has adorned the soul in her own proper jewels, which are temperance, and justice, and courage, and nobility, and truth.'[2]

If, from these heights on which philosophic thinkers have delighted to tread, we pass down to the lowest levels on which uncivilised tribes are dwelling now, we shall see the extremes of thought possible for the rational life in the world. On this point, a better witness than Tylor could not be chosen, when treating of 'Animism' or 'belief in spiritual beings,'[3] existing apart from organism, whether these be the ancestors of the people, or a higher order of spirits. The general conclusions as to the working of thought among savage tribes, reached by Tylor, after deliberate examination, may appear from these extracts. 'So far as I can judge from the immense mass of accessible evidence, we have to admit that the belief in spiritual

[1] Plato's *Apology*, 40, 41. Jowett's Transl.
[2] *Phaedo*, 113 and 114. Jowett's Transl.
[3] *Primitive Culture*, vol. i. p. 425.

beings appears among all low races with whom we have attained to thoroughly intimate acquaintance.'[1] The following is his contrast, 'when the several races of men are looked at ethnographically,' with a view to ascertain 'the general relations of the lower to the higher culture, as to the belief in future existence:'[2] 'On the savage side, we find the dominant idea to be, a continuance of the soul in a new existence, like the present life, or idealised and exaggerated on its model; while on the cultured side, the doctrine of judgment and moral retribution prevails with paramount, though not indeed absolute, sway.'[3] With illustrations before us of Greek thought, prior to the Christian era, and with such testimony as that of Tylor, depending on the widest inductions, it seems clear that belief in a future state is a natural product of reflection, when dealing with the facts of the present life. If then, we would complete our view of man's place in Nature, we must hold that Expectation is as essential to a rational life as Memory proves to be. Such Expectation is not the expression of Experience. While it stands related with experience, it arises out of the conditions of thought itself, as it bears on the Unknown.

Under the conditions of a rational life, it happens, that to men all the world over, the gates of death are not opened and shut on the darkness of a closing tomb. The body does not seem the man; the link of sympathy does not seem broken, though the eye be glazed, and the ear be dull. Even if the body be not buried out of sight, but placed on the funeral pile, the expiring flame, which flickers and dies before afflicted

[1] *Primitive Culture*, vol. i. p. 425.

[2] *Ibid.* vol. ii. p. 100.

[3] *Ibid.* vol. ii. p. 101.

onlookers, does not seem to end all, or to break the bonds of affection which had grown strong in this life.

With impressive agreement, shared by those far removed from each other, even ignorant of each other's language, men have persisted in looking to the gates of death as also gates of life,—entrance to the pathway leading to another world. Gazing on these dark portals, Obligation and Responsibility have seemed as lamps shedding radiance behind and before, on the Known and the Unknown. If at this crisis in life's way, there be a stirring of fear, there is also a rising of hope. To those uttering their parting word on the confines of the Unseen, an experience so strange is given, that it appears to them as if they had one foot in this world, the other in a world invisible.

If there be in the history of rational life, better thought than this,—clearer and more inspiring,—it is where Christian thought has sway. It is where men believe that Jesus Christ 'has brought life and immortality to light through the Gospel;'—where with strength of faith they advance; with brightened eye they see Him with victor's hand opening the gate of life; while their ear vibrates to the tones of a gentle voice, uttering words long familiar,—'I am the way, and the truth, and the life.' This is the grander utterance, spoken for behoof of our whole race. It is an utterance meeting the longings of humanity, in conscious fulfilment of which life is at once enlarged. The words proclaim 'Continuity of Life' in a grander sense than appears in the annals of natural history. They are the promise of a life, having kinship with the immortals, and which is itself prepared for fellowship with the Eternal Father of the spirits of men.

Our view of Man's Place in Nature is now completed. Research, extended over the wide field of comparative biology, has accumulated a large body of evidence demonstrating the impossibility of tracing the origin of man's rational life to evolution from a lower life. There are no physical forces discoverable in Nature, sufficient to account for the appearance of this life. The insufficiency of the evidence for its evolution becomes increasingly obvious, as the demands are more exactly ascertained. Animal Intelligence shows no effective preparation for Rational Intelligence. All the best examples of Intelligence among the animals present results of human training. These results testify to relations historically later than those upon which a theory of Evolution can rely. Nor can the characteristics of rational life be explained by any possible advance in the structure of nerves and brain. Neither continuance, nor repetition, nor recollection of sensory impressions made upon us, can explain the reflective exercise known in consciousness.

Throughout the preceding investigation, the object has been to ascertain all facts bearing on the history of life on the earth, and to seek their interpretation. Pursuit of this object, has led us to remark the severance of two distinct modes of inquiry, the one including the whole range of external existence, the other including the whole facts of personal experience. The severance of these two is inevitable and insuperable. External observation concerns itself with the wide field of material existence, including all forms of organic life; amongst these, the animal life of man himself. It cannot include the functions of Mind. Internal Observation deals with the complexities of

consciousness, thereby discovering the powers of a rational life. It cannot include the functions of organism, not even of nerves and brain. The contrast between these modes of knowing, points to contrast in the phases of existence known. Nature includes both; yet Evolution of the higher from the lower,—the mental from the physical,—is impossible.

The significance of Evolution becomes more conspicuous, when its natural limits are clearly recognised. The progress of organic life is thereby seen in its unity. Its beginnings, its development, and its consummation, are taken together, showing the coherence of organic existence on the earth. Biology is a natural history of organic life in the world, from its first appearance till now. This history began, as Darwin suggested, in primordial forms of the lowest order; it closes in the marvellous elaboration of the human organism, the most wonderful combination of physical structure and function which Nature contains. The natural history of organic life finds its interpretation in the induction as to Evolution which has made its lasting impression on our age.

The Rational Life of Man stands out to view on an eminence completely severed from this scheme of organic evolution. As an animal life—a type of physical existence—human life is fitted into the system of organic life on the earth. As a rational life—a type of spiritual existence—human life is exalted above all life besides, severed from companionship of animals. Man is a member of an intelligent order, possessing kinship with all rational beings, wherever such may dwell, who together constitute a spiritual kingdom within creation. As the result of

the investigations now closed, these two orders of being, the one organic, the other spiritual, appear in vivid contrast. The striking fact is, that man belongs to both. He has his place in a physical system, within which all is subject to decay and death; he has his place in a spiritual system, within which is no trace of death, but promise of continuity beyond the present state, where there may well be a community of spiritual existence. 'No fact in Nature is fraught with deeper meaning than this two-sided fact of the extreme physical similarity, and enormous psychical divergence, between Man and the group of animals'[1] nearest to him in the history of organic life. When this contrast is steadily observed, we find logical support for the representation of a Spiritual Kingdom, having a perpetuity of which Nature itself offers no promise.

Along with this 'enormous psychical divergence' of human life from all life besides, we must include the evidence in Natural History for gradation in the ascent of being. This is such that the appearance of mental life is not *per saltum*, but by transition, in harmony with the analogies familiar in Nature. Man does not look upon Nature as if it were merely a realm of material existence, governed by mechanical force, to which he is alien. He does not move among the varied forms of animal life, as a stranger, or as an adversary, but as one allied to all that breathes and moves. He does not exercise lordship over all, without finding near him, in close alliance with him, higher orders of life, possessing a humbler type of mind, through which it is possible for him to communicate

[1] Fiske's *Destiny of Man*, p. 29.

some share of his purpose, and to introduce the higher animals to some share in his work. This inferior type of Mind, recognised as belonging to the higher animals, cannot be accounted for by evolution from sensory apparatus, any more than rational power can be thus explained. Mind in animal is the beginning of a new order in the history of Nature, as certainly as was the appearance of organic life itself, at a vastly earlier period.

Guided by the conclusions reached in course of this inquiry,—conclusions negative and positive,—destructive and constructive,—we are enabled to form an enlarged conception of the history of Nature as an orderly system. Evolution has turned attention on different phases of the origin of existence on the earth. It helps us better to see how varied these origins have been. We have seen that Darwin formally declares that he has 'nothing to do' with 'the origin of life itself;' and further, that he has 'nothing to do with the origin of the mental powers.'[1] We may be assured that he had thoroughly gauged the vast range of data at command, before he formally announced these reservations as to the origins of Life and Mind. In accordance with these declarations, is the acknowledged insufficiency of a theory of Evolution to account for life itself, whether it be organic or spiritual. Evolution stands before us as an impressive reality in the history of Nature. But this Evolution is only a limited cycle, within the greater cycle of Being and its History.

Beyond this inference, evidence leads clearly to the conclusion, in which we gather up the results of our survey of the orderly system in the midst of which we

[1] *Origin of Species*, p. 191.

live. There is a Power operating continually in Nature, which does not come within range of the observation possible to scientific modes and appliances, yet to which Science is ever indirectly bearing witness. This Power has manifested itself at the most impressive periods in the world's history, first at the appearance of Organic Life, again on the appearance of Mind, and again on the advent of Rational Life. At each of these great epochs commencement is given to a grander advance than had been possible under earlier conditions. All Nature testifies not only to government by fixed law, but also to the action of a power whose dominion is expressed at once in each single law, and in the entire system of things as constituted at any given period in history, and in the appearance of new orders of existence, adding to the complexity of the system as a whole. This power is no *Deus ex machina*. Of the Living Source of all existence, in the midst of which we move, to which we belong, and the science of which we rationally construct, there is no true conception under representation of a God dwelling apart from Nature. This can be found only in the representation of a God immanent in Nature,—immanent, yet transcendent,—transcendent, yet immanent. The representation which would place the Infinite Being 'afar off,' as if He dwelt apart from Creation, is alien to scientific knowledge, inconsistent with the records of natural history, at variance even with the conditions of rational life. In harmony with thought finding expression wherever man appears, we recognise the Supernatural within the Natural. We cannot, indeed, vindicate for humanity a general claim to clearness and consistency

in thinking of the deeper problems of life. But even of the common thought concerning the Supernatural, we can say with Kant, 'The track it pursues, whether rational or sophistical, is at least natural, and not only goes far to persuade the common understanding, but shows itself deserving of respect from the speculative intellect.' This is the thought expressing itself in some form of the argument from design. It is always in some measure the logical result of man's regard to causality; and, perhaps even more, it is the expression of the religious sentiment, which, to use the language of Hume in reference to 'the moral sense,' 'Nature has made universal in the race.' Of Nature, as interpreted by Science, there is no key other than is found in recognition of an Immanent and Intelligent Cause, in the midst of all, and concerned with all, that belongs to the history of Being. This is the First Cause—the Eternal Personality,—related to the spiritual life of rational souls, as He can be related to no other type of existence within the wide sphere of Creation.

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